

Official Transcript of Proceedings

NUCLEAR REGULATORY COMMISSION

Title: Advisory Committee on Reactor Safeguards
 Subcommittee on the Westinghouse AP1000
 DCD and AP1000 RCOL: Open Session

Docket Number: (n/a)

Location: Rockville, Maryland

Date: Monday, September 20, 2010

Work Order No.: NRC-433

Pages 1-103

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ADVISORY COMMITTEE ON REACTOR SAFEGUARDS

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UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

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ADVISORY COMMITTEE ON REACTOR SAFEGUARDS

(ACRS)

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SUBCOMMITTEE ON THE WESTINGHOUSE AP1000 DCD AND

AP1000 RCOL

+ + + + +

OPEN SESSION

+ + + + +

MONDAY, SEPTEMBER 20, 2010

+ + + + +

ROCKVILLE, MARYLAND

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The Subcommittee met at the Nuclear
Regulatory Commission, Two White Flint North, Room
T2B1, 11545 Rockville Pike, at 8:30 a.m., Harold B.
Ray, Chairman, presiding.

SUBCOMMITTEE MEMBERS:

HAROLD B. RAY, Chairman

SAID ABDEL-KHALIK, Member

SANJOY BANERJEE, Member

MARIO V. BONACA, Member

CHARLES H. BROWN, Member

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P-R-O-C-E-E-D-I-N-G-S

8:30 a.m.

CHAIRMAN RAY: The meeting will now come to order. This is a meeting of the AP1000 Reactor Subcommittee, a standing subcommittee of the Advisory Committee on Reactor Safeguards.

I'm Harold Ray, chairman of the subcommittee. ACRS members in attendance are Charles Brown, Sanjoy Banerjee, Said Abdel-Khalik and Mario Bonaca. ACRS consultants, Tom Kress, Graham Wallis and Myron Hecht are also present. Member Sam Armijo we believe will join us tomorrow. Weidong Wang is the designated federal official for this meeting.

This meeting is part of the ongoing review of a proposed amendment to the AP1000 Pressurized Water Reactor Design Control Document and review of the associated combined license applications.

In the past we've had seven AP1000 subcommittee meetings, which were in July, October and November of 2009, February, April, June and July of 2010.

This September AP1000 Subcommittee meeting will continue to review the safety evaluation reports on Revision 17 to the AP1000 DCD and the Vogtle AP1000 Reference Combined License Application. Following

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1 chapters will be covered during the meeting: With
2 regard to DCD Rev. 17, Chapter 5, 7, 8, 13 and 18; and
3 with regard to the Vogtle Reference COL, Chapters 7
4 and 18.

5 We will hear presentations from DCD
6 applicant Westinghouse, Vogtle Reference COL applicant
7 Southern Nuclear Operating Company, which is supported
8 by NuStart, and from the NRC staff.

9 We received no written comments or
10 requests for time to make oral statements from members
11 of the public regarding today's meeting.

12 As shown on the agenda, some presentations
13 beginning right away will be closed in order to
14 discuss information that is proprietary to the
15 applicants and its contractors pursuant to 5 U.S.C.
16 552(b), (c), (3), and (4).

17 Attendance at these portions of the
18 meeting dealing with such information will be limited
19 to Southern Nuclear Operating Company, NuStart, South
20 Carolina Electric & Gas and Westinghouse
21 representatives, and the NRC staff and its consultants
22 and those individuals and organizations who have
23 entered into appropriate confidentiality agreement
24 with them. Consequently, we will need to confirm that
25 we have only eligible observers and participants in

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1 the room for the closed portions.

2 The Subcommittee will gather information,
3 analyze relevant issues and facts and formulate
4 proposed positions and actions as appropriate for
5 deliberation by the full committee.

6 The rules for participation in today's
7 meeting have been announced as part of the notice of
8 the meeting published previously in the *Federal*
9 *Register*.

10 A transcript of the meeting is being kept
11 and will be made available as stated in the *Federal*
12 *Register* notice, therefore we request that
13 participants in this meeting use the microphones
14 located throughout the meeting room when addressing
15 the subcommittee. Participants should first identify
16 themselves and speak with sufficient clarity and
17 volume so that they may be readily heard.

18 We will now proceed with the meeting.
19 First, let me invite any comments from a member.

20 Said?

21 MEMBER ABDEL-KHALIK: Mr. Chairman, I have
22 a conflict with the COL applicant and therefore I will
23 not participate in discussion specifically related to
24 the Reference COLA.

25 CHAIRMAN RAY: Thank you.

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1 Eileen, any comments from staff? We're
2 going to close the meeting here shortly.

3 MS. McKENNA: Yes, this is Eileen McKenna,
4 NRC Office of New Reactors. No, we have no opening
5 comments. Thank you.

6 CHAIRMAN RAY: Okay. All right. With
7 that, we are prepared, I believe, to proceed to the
8 first agenda item, which is DCD Chapter 7. This is to
9 be a closed meeting, so I must first begin by asking
10 that the applicants and those named in the statement I
11 just read assure me that we have only those who are
12 authorized to be here in the audience and that any who
13 are not please step outside until the closed meeting,
14 which scheduled on the agenda to go to lunch, is
15 completed. It will then I guess be closed after lunch
16 as well until the afternoon break.

17 So, any members not meeting the
18 qualifications for being in the closed
19 meeting, any attendees should depart.

20 (Whereupon, at 8:34 a.m. off the record
21 until 1:49 p.m.)

22 CHAIRMAN RAY: All right. Ravi?

23 MR. JOSHI: Hi, my name is Ravi Joshi.
24 I'm an APM for Vogtle. We'll talk about Chapter 7,
25 but I think I just want to go back to the memo that we

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1 wrote to -- in Chapter 7.

2 CHAIRMAN RAY: He's opening the open line
3 now since the closed meeting is over with.

4 MR. JOSHI: Okay.

5 (Whereupon, the phone line was reopened.)

6 MR. JOSHI: Okay. Once again, my name is
7 Ravi Joshi. I'm going to actually -- we don't have
8 any prepared presentation for Chapter 7 and just
9 wanted to read the memo that we put together when we
10 transmitted our Chapter 7 to ACRS.

11 One of the thing we said that we usually
12 look at the memo which is dated February 17, 2010,
13 memorandum to EDO and that requires us to look at the
14 significant items that we need to identify in our
15 memo. And what we actually came up with there was no
16 significant items. On the top of that we actually
17 came up with some additional rational that to us
18 saying that we don't really need to provide anything
19 to the ACRS subcommittee.

20 And this is what we said in our memo.
21 What we said were the chapter 7 for the Vogtle consist
22 mainly of the information incorporated by reference
23 IBR. And there were two additional added, and we talk
24 about those items, one related to the Safe Point
25 Program which is part of Chapter 16, and we already

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1 presented that there. And the information associated
2 with reports as to the monitoring. And the second we
3 said that as a part of the standard content SER open
4 items, there were no open items there. So, there's
5 nothing really that we want to add to there.

6 However, we are ready here to prepare to
7 provide any kind of questions members may have. I
8 have Terry Jackson from the staff here to respond to
9 any questions. And we also we have -- if the
10 questions are related to COL, we have our COL staff
11 also available to provide any comments or questions
12 you may have.

13 CHAIRMAN RAY: Well, I'd dearly love to
14 know how the COL applicant feels about the issues
15 raised in the U.K., but I'm not going to ask them at
16 this point because I don't think it would be fair.
17 So, I don't have anything more to say.

18 Does any of the other members have for the
19 COL applicant or staff on Chapter 7?

20 MEMBER BROWN: Well, is the staff going to
21 talk to us about U.K. issues, I mean, that they
22 have --

23 CHAIRMAN RAY: Not now, because they don't
24 involve the amendment.

25 MEMBER BROWN: Well, what if they're

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1 important?

2 CHAIRMAN RAY: We will address them.

3 MR. SANTOS: This is Dan Santos from the
4 staff. We can talk to technical issues, and I think
5 the management communicated to some other members that
6 we can talk to the committee separate or separate
7 meeting.

8 CHAIRMAN RAY: Yes, this is an open
9 meeting now. We will definitely meet with the staff.
10 I just think that they need to be sure they're ready
11 to talk to us and we need to have --

12 MEMBER BROWN: I just want to get a handle
13 on what are the safety implications of their
14 objections --

15 CHAIRMAN RAY: Right. Understood.

16 MEMBER BROWN: -- so that we can at least
17 -- you know, okay, we agree or disagree.

18 CHAIRMAN RAY: Right.

19 MEMBER BROWN: And we really didn't get
20 into that at all.

21 CHAIRMAN RAY: Deliberately.

22 MEMBER BROWN: Understood. Okay.

23 MR. SANTOS: Just one quick question from
24 the staff. Will that fall into the -- other ACRS
25 subcommittee purview or under this subcommittee?

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1 CHAIRMAN RAY: I need to talk to my
2 chairman here. It may well.

3 MR. SANTOS: Okay. Thank you.

4 CHAIRMAN RAY: I'm just trying to get the
5 amendment process at this point. I am sensitive
6 though to the possibility that the amendment is
7 implicated by those items and that's why I wanted to
8 be as clear as I could given the uncertainty that's
9 involved.

10 Anyway, back to Chapter 7 here on the part
11 of the staff and applicant for the COL. Any issues
12 that anyone has? Any questions you want to ask beyond
13 what's already been said?

14 MEMBER BROWN: No, just mostly IBR.

15 MR. JOSHI: That's the reason we decided
16 not to provide any specific presentation other than if
17 you have any questions.

18 CHAIRMAN RAY: Yes. Okay. Well, thank
19 you for coming in, Ravi.

20 MR. CUMMINS: So, if I might make a
21 comment. There are tables in Chapter 7 about time
22 response tables, required time response tables. And
23 there's one table which is --

24 MEMBER BROWN: DCD?

25 MR. CUMMINS: In the DCD Chapter 7, table

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1 7.2.1 is for reactor trip and 7.3.4 is for ESFAS. And
2 they list several pages of time response requirements
3 for the whole process from detection to actuation. So
4 that is, as they discussed -- originally starts on the
5 safety analysis and gets recorded as a requirement
6 that passed down to the I&N system in Chapter 7.

7 CHAIRMAN RAY: You're mentioned that here,
8 Ed, for what reason?

9 MR. CUMMINS: Because it was kind of an
10 item that was discussed with some confusion this
11 morning on Chapter 7.

12 CHAIRMAN RAY: Yes, but it was in the
13 context of the DCD.

14 MR. CUMMINS: Right.

15 CHAIRMAN RAY: All right. It doesn't
16 pertain to the COL.

17 MR. CUMMINS: No, it doesn't. It doesn't.

18 CHAIRMAN RAY: Okay.

19 MR. JOSHI: Okay. Thank you.

20 CHAIRMAN RAY: All right. Now, we will
21 hear on the DCD Chapter 8, applicant, staff. And
22 Chapter 13, it says the staff. Electrical power
23 systems.

24 MEMBER BROWN: Ed, you said table 2, 7.2?

25 MR. CUMMINS: Seven-point-two-dash-one and

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1 seven-point-three-dash-four.

2 MEMBER BROWN: Okay. But those were
3 typical. I mean, I remember looking at that, but
4 those it just says "typical," which means sort of.

5 MR. CUMMINS: Yes.

6 MEMBER BROWN: No, I just want to make
7 sure I understood the context.

8 MR. CUMMINS: Yes.

9 MEMBER BROWN: Okay. I thought there was
10 something that said, hey, this is the ironclad armor
11 plated, and they're not. This is --

12 MR. CUMMINS: Yes.

13 CHAIRMAN RAY: Yes, one of the problems we
14 have as I said several times before is getting comfort
15 with the idea that there are objective criteria that
16 have to be met.

17 MEMBER BROWN: Well, the same thing
18 applies with accuracy. It says here's typical
19 accuracies of the instruments. And I don't know how
20 you do an analysis of the transient performance if you
21 don't have the actual accuracies that's going to work
22 againts those typicals.

23 MR. CUMMINS: Well, this is Ed Cummins
24 again. I think that how you interpret typical and how
25 we interpret typical are a little different. And we

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1 would say these are baseline requirements. We would
2 interpret it that way. And if we found that we didn't
3 meet them, we would have to revisit the safety
4 analysis to make sure that they could accept a longer
5 period. So, how we deal with them, we say typical so
6 that it's easier to change, but it's more like
7 requirements to us.

8 CHAIRMAN RAY: But we've got that on the
9 transcript now, Ed, and we're going to take a lot of
10 comfort in that, believe you me. Thank you.

11 Okay. Even though you've lost your sign,
12 Bob, you want to go ahead?

13 MR. SEELMAN: Yes, good afternoon again.
14 There's a little breeze up here which took the sign
15 right off the table, but my name is Bob Seelman and
16 would again thank the Chairman and the committee for
17 allowing us to present -- this is DCD Chapter 8,
18 Electrical Power.

19 To my right is Mark DeMaglio. He is a
20 subject matter expert for the DCD Chapter 8.

21 In the fall of 2009 we presented to the
22 committee the design changes made to the certified
23 design. The NRC Staff Safety Evaluation Report
24 identified five open items. In that presentation we
25 also presented how we plan to address those open

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1 items. Today we'll discuss that and address how we
2 achieved closure on those.

3 The AC power systems, including the
4 diesel-backed systems, have a safety function. The
5 power design is based on Regulatory Guidelines and
6 standards. These Reg Guides or standards are listed
7 in Section 8.1.4.3 of the DCD.

8 CHAIRMAN RAY: And you meant to say have
9 no safety function?

10 MR. SEELMAN: Yes, that's right.

11 CHAIRMAN RAY: Yes.

12 MR. SEELMAN: Thank you for correcting
13 that.

14 CHAIRMAN RAY: Remember there's a
15 transcript.

16 MR. SEELMAN: Yes, thanks. As stated in
17 this slide, the only AC power needed by the plant is
18 that provided by Class 1E batteries and their
19 inverters.

20 What I will do, I'm going to ask Mark to
21 address this slide. This slide shows typical
22 divisions A and D. This slide and the next slide will
23 give you an overview of the Class 1E DC division.

24 MR. DeMAGLIO: Okay.

25 MR. SEELMAN: Go ahead, Mark.

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1 MR. DeMAGLIO: This slide is a simplified
2 sketch of a division. This is Alpha division in this
3 case of the IDS system, the DC power and inverter
4 power system for safety function for AP1000. It's
5 fairly a typical UPS-type system. In this case it
6 provides all the power, the mode of power required to
7 accomplish safe shutdown and maintain safe shutdown.

8 This is your battery, your DC
9 distribution, your inverter, your AC distribution
10 below the inverter. Also shown here is the non-safety
11 source that backs these under normal operating
12 conditions.

13 The next slide division representative of
14 division Bravo and Charlie, division Bravo on this
15 slide. Division Bravo and Charlie have the slide you
16 saw previously, a standard 24-hour system.

17 MEMBER BROWN: Does something charge these
18 batteries? Excuse me.

19 MR. DeMAGLIO: I'm sorry. Yes, sir?

20 MEMBER BROWN: Does something charge these
21 batteries?

22 MR. DeMAGLIO: Batteries are charged
23 through normal AC power.

24 MEMBER BROWN: Okay. So, none of that's
25 shown. All of the site, potential site?

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1 MR. DeMAGLIO: That's correct. That's
2 shown in the small dashed-outline box in the top
3 center of the page. The on-site standby diesel
4 generator backed low voltage AC power supply. That is
5 your non --

6 MEMBER BROWN: Oh, that's your switchyard
7 contribution?

8 MR. DeMAGLIO: That's your plant.

9 MEMBER BROWN: Okay. All right. I didn't
10 interpret the backed low voltage AC power supply --

11 MR. DeMAGLIO: It's actually 40-volts
12 system level.

13 MR. SEELMAN: The difference here between
14 this slide and the previous slide is division Bravo
15 and Charlie have both a 24-hour and a 72-hour train as
16 represented on the edges of the drawing with the 24
17 and 72-hour batteries. Again, those are the only two
18 divisions that have this. We've included this slide
19 to show the difference between the Alpha and Delta,
20 the Bravo and Charlie divisions.

21 Again, fairly straightforward UPS system.
22 Here the difference being that there is again two
23 full sets of batteries supporting two different
24 functions, both the 24-hour functionality and the 72-
25 hour functionality separately from that.

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1 MEMBER BROWN: Why are they different?

2 MR. SEELMAN: They're fully separate sets.

3 The 24-hour is used in the shutdown process.

4 MEMBER BROWN: No, why are A and D
5 different than B and C?

6 MR. SEELMAN: Oh, Bravo and Charlie
7 require on the two 72-hour post-accident monitoring
8 channels. Alpha, Bravo, Charlie and Delta 24 are the
9 fully-redundant shutdown paths. And then the Bravo
10 and Charlie 72 are the 72-hour post-accident
11 monitoring functionality, so they only have two
12 divisions of functionality.

13 MEMBER BROWN: The on-site diesel
14 generator is the same in both of these? Is picture 1
15 encompassed in picture 2?

16 MR. SEELMAN: The same on-sit diesel
17 generator system --

18 MEMBER BROWN: No, well, the left hand
19 set, a 24-hour battery bank.

20 MR. SEELMAN: Yes. If you look at the
21 left --

22 MEMBER BROWN: If you look at this one,
23 that looks like the previous picture.

24 MR. SEELMAN: That's correct. The left
25 half of the second is the same as the entire picture

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1 of the first.

2 MEMBER BROWN: Thank you.

3 MR. SEELMAN: You're welcome. Any other
4 questions on that slide?

5 MEMBER BROWN: No, I'm finished. I just
6 had to understand it.

7 MR. SEELMAN: In the next few slides we
8 will present how the open items identified in the SER
9 were addressed.

10 This first open item was related to low
11 profiles for the batteries. The staff was interested
12 in low profiles, battery margin and service life. We
13 have provided the staff with battery sizing
14 calculations for review. The staff found the
15 calculations validated, that the batteries would
16 envelop their load profiles throughout their design
17 life. This item is resolved.

18 The last bullet on the slide identifies
19 the location of the DCD where this information is
20 documented.

21 The next open item was related to the
22 battery test plan. The staff wanted to know how the
23 batteries will be qualified for the service life.
24 Westinghouse provided the battery test plan to the
25 staff for review. The staff found the plan to be

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1 acceptable but requested that specific wording be
2 added to the DCD that test plans would meet or exceed
3 the IEEE standards. This item is also resolved. It
4 is the confirmatory item that will be closed upon
5 verification that the requested wording changes were
6 made to the DCD.

7 Open item EEB-05. Open item 5 is related
8 to the adequacy of the DC power system. The staff was
9 concerned about Westinghouse's methodology for sizing
10 batteries and battery chargers. Westinghouse provided
11 the staff with design calculations for their review
12 and the staff found that the batteries are sized in
13 accordance with the standards. This item is also
14 considered resolved.

15 Westinghouse does have one internal
16 action. Based on its review of the calc note, the
17 staff has requested that clarification be made to the
18 calc note regarding the required capacity of the 72-
19 hour battery. The statement on battery capacity will
20 be clarified in the next revision of the calculation
21 which is scheduled for January 2011. It is expected
22 that the staff will review that revised calc as part
23 of the ITAAC for the DC system prior to plant start-
24 up.

25 Any questions on that?

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1 MEMBER BROWN: Are these part in tier 1
2 from the ITAAC for DAC?

3 MR. DeMAGLIO: There is an ITAAC on the
4 system.

5 MR. SEELMAN: There is no DAC-related
6 chapter.

7 MEMBER BROWN: Okay.

8 MR. SEELMAN: Item 08. In open item No. 8
9 the staff was concerned about the secure transfer of
10 configuration-controlled information to the COL
11 applicant. Westinghouse provides the applicant with
12 an electrical transient analysis program for use as a
13 tool to verify the design support's safety-related
14 loads. This item is also resolved.

15 No. 9, Battery Chargers and Voltage
16 Regulating Transformers. This last open item is
17 related to the voltage protection of battery chargers
18 and inverters. The staff wanted to ensure that
19 periodic testing would be performed on battery
20 chargers and voltage regulator transformers.
21 Westinghouse agreed to add a COL information item to
22 the DCD to address this item. This item is resolved
23 and it's categorized as a confirmatory item. As you
24 see on the slide there the last bullet identifies the
25 COL information item, where it is located in the DCD.

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1 CHAIRMAN RAY: Now, is that being changed
2 by the resolution of this open item, or added, the DCD
3 combined license information item?

4 MR. SEELMAN: The DCD is being revised to
5 address this open item, the wording.

6 CHAIRMAN RAY: Yes.

7 MS. McKENNA: I think your question is
8 there's a new COL information item resulting from this
9 statement.

10 CHAIRMAN RAY: Yes. Okay.

11 MS. McKENNA: It will appear in Revision
12 18, which is why when the staff talks about it, you
13 hear this confirmatory item on that point.

14 CHAIRMAN RAY: Thank you, Eileen. In
15 other words, if I went and looked for this, I would
16 not find it in Rev. 17?

17 MS. McKENNA: Correct.

18 MR. SEELMAN: Any other questions?

19 (No audible response.)

20 MR. SEELMAN: In conclusion, the SER
21 contains no open items. There are two confirmatory
22 items pending verification in the DCD.

23 That concludes Chapter 8. Any questions?

24 CHAIRMAN RAY: Well, I don't have any.
25 Charlie, you or Mario?

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1 MEMBER BROWN: I have one relative to the
2 ITAAC in this thing. When I looked at that, I saw a
3 lot of things that, you know, said, hey, the ancillary
4 diesel will be operated. We sized it right. But I
5 didn't see any tests that show to test the -- either
6 that or I missed it, relative to if you lost AC power
7 that it would then pick up the load without any burps
8 or slurps or anything else.

9 CHAIRMAN RAY: It's not safety-related,
10 you realize.

11 MEMBER BROWN: What?

12 CHAIRMAN RAY: You realize it's not
13 safety-related, this diesel?

14 MEMBER BROWN: Well, they talk about Class
15 1E in here.

16 CHAIRMAN RAY: Yes, but the diesel doesn't
17 perform a safety function. Right?

18 MEMBER BROWN: That's power. It just says
19 Class 1E breaker control.

20 MR. CUMMINS: This is Ed Cummins. He's
21 talking about the ancillary diesel, right? That was
22 the word you were reading?

23 MEMBER BROWN: No, I'm just talking about
24 if you got UPSs in the electric power system and this
25 applying a Class 1E loads, then theoretically if you

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1 lose AC power they should transfer to the AC load -- I
2 mean, to the battery backup power supply.

3 MR. CUMMINS: Yes.

4 MEMBER BROWN: And that's all I'm talking
5 about.

6 CHAIRMAN RAY: I thought you were talking
7 about the diesel.

8 MEMBER BROWN: No, no, no, no. I'm
9 missing that as I was sliding through, that they were
10 doing certain things to show that that diesel did --

11 CHAIRMAN RAY: All right. Then never mind
12 what I said.

13 MEMBER BROWN: -- something. I was just
14 looking for a test that the UPSs actually picked up
15 the loads and that they were -- in other words, their
16 sizing criteria actually turned out to be correct. I
17 didn't see testing at all for that. Is it in there,
18 or --

19 MR. CUMMINS: Ed. Cummins. I believe the
20 ITAAC specify capacity of the battery charger and
21 capacity of the inverter and capacity of the
22 regulating transformer. So, that's --

23 MEMBER BROWN: Well, it specifies it, but
24 I mean, does anybody run a test to see that it
25 actually picks up in accordance with the way it was

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1 designed?

2 MR. CUMMINS: Yes, I think you have to
3 prove in the ITAAC that you can handle that capacity.

4 CHAIRMAN RAY: You're talking about a
5 start-up test?

6 MEMBER BROWN: Yes, I'm talking -- I'm
7 sitting here operating a bunch of loads.

8 CHAIRMAN RAY: I'm just asking.

9 MEMBER BROWN: Your AC power disappears.

10 CHAIRMAN RAY: The answer's yes. He's
11 talking about a start-up test.

12 MR. CUMMINS: Yes, there are start-up
13 tests for the --

14 MEMBER BROWN: And it shifts? And if I
15 lose power, does it shift to the thing seamlessly?
16 That's all.

17 MR. CUMMINS: Yes.

18 MEMBER BROWN: I didn't see a test under
19 the ITAACs that does that. If there's another
20 classification of tests, operational tests, start-up
21 tests, that's fine, but I didn't know where to look
22 for that.

23 CHAIRMAN RAY: I assume there would be a
24 start-up test, but you've answered the question.

25 MR. CUMMINS: Yes, there will be a start-

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1 up test of the system.

2 CHAIRMAN RAY: Yes.

3 MR. DeMAGLIO: To demonstrate the system
4 performs.

5 MR. DeMAGLIO: It will be in Chapter 14.

6 CHAIRMAN RAY: Chapter 14? Okay.

7 MEMBER BROWN: Chapter 14? What is
8 Chapter 14?

9 MR. CUMMINS: Start-up tests.

10 MEMBER BROWN: Thank you. I forgot. I
11 don't know all these yet. So, that's where you go to
12 find -- so that would test it not just for starting it
13 up, I mean, this is more than a start-up. This is --

14 CHAIRMAN RAY: Start of an operation, yes.

15 MEMBER BROWN: This is an operation and
16 you lose AC power and it seamlessly picks up the load
17 without any --

18 MR. DeMAGLIO: Continues to carry loads
19 without loss, correct.

20 MEMBER BROWN: Okay. And that will be
21 under Chapter 14?

22 MR. DeMAGLIO: Yes, I believe so.

23 MEMBER BROWN: Okay. So, how do I find
24 that? So, there's no ITAAC on that? It's just
25 specified under start-up testing? There's a separate

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1 set of tests that were called out in Chapter 14?

2 MR. DeMAGLIO: I'm going to let Rob finish
3 searching instead of --

4 PARTICIPANT: I can take an action to --

5 MR. SISK: Yes, let me go offline. We'll
6 get back with an actual citation.

7 MEMBER BROWN: Okay. Thank you.

8 CHAIRMAN RAY: All right. Anything else
9 to the applicant on Chapter 8?

10 (No audible response.)

11 CHAIRMAN RAY: Thank you. We'll hear from
12 the staff now.

13 MR. JAFFE: Good afternoon.

14 CHAIRMAN RAY: That's a very thin package
15 you have there, David.

16 MR. JAFFE: Thank you, sir. My name is
17 Dave Jaffe. I'm the staff's project manager for
18 Chapter 8. As you know, we previously presented our
19 Phase IV Safety Evaluation With Open Items, and we're
20 back again. This time we've resolved, as you know,
21 the open items and we'll cover some of the ground that
22 Westinghouse did, but I think what we'll do is steer
23 towards the ones that we think are more significant.

24 I'd like to present Om Chopra who has been
25 our principal reviewer on Chapter 8, and we'll address

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1 closure of the open items.

2 MR. CHOPRA: Good afternoon. I'm Om
3 Chopra from Electrical Engineering Branch, Office of
4 New Reactors.

5 Last year I reported to the committee that
6 there were five open items in AP1000 design, and they
7 were in the areas of -- we were looking for the load
8 profiles for each of the 24-hour and 72-hour
9 batteries, battery qualification, battery and battery
10 charger sizing calculations and AC design
11 calculations, coordination with the battery chargers
12 and inverters. So, all items have been resolved and
13 now we have two confirmatory items. I'm going to
14 touch upon the two confirmatory items.

15 The first one was the battery
16 qualification. The staff has looked at the battery
17 qualification and we conclude that the methodology
18 used by Westinghouse to qualify the batteries are
19 consistent with IEEE 323, 344 and 535. However, we
20 requested Westinghouse that this qualification program
21 should be captured in the DCD, because there was no
22 mention of qualification of the batteries in the DCDs.

23 So, they have agreed to revise their DCD to include a
24 summary of the qualification program.

25 MR. JAFFE: That will be confirmed on

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1 receipt of Revision 18 to the DCD.

2 MR. CHOPRA: The next item, confirmatory
3 item is we were concerned about the effect of voltage
4 transient during islanding mode of the operation. In
5 other words, when the generator is disconnected -- let
6 me go back a little bit. AP1000 design has 100
7 percent load rejection capability. So, in that
8 instant the main generator disconnects itself from the
9 grid and supply the plant. So, we were concerned that
10 in this instances the voltage can really spike very
11 high and that could really propagate to the DC system.

12 And we were looking for a proper coordination between
13 the chargers and the inverters so that the battery
14 charger breaker opens and let the inverter -- the
15 batteries power the inverter and the safety loads.

16 And this is a confirmatory item. They
17 have agreed to provide proper coordination and they
18 will coordinate the battery chargers about 10 percent
19 higher than the inverters. So just to be safe, that
20 in this instances the battery charger opens -- the
21 protective device opens first before the inverter.

22 CHAIRMAN RAY: So, will this open normally
23 on a load rejection or just when the voltage spikes?

24 MR. CHOPRA: If the voltage --

25 CHAIRMAN RAY: If the voltage spikes?

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1 MR. CHOPRA: Yes.

2 CHAIRMAN RAY: Okay. So, it won't
3 necessarily disconnect from the generator output?

4 MR. CHOPRA: No, it --

5 CHAIRMAN RAY: It's only if the voltage
6 goes up?

7 MR. CHOPRA: Yes. Right. Only during
8 this instance.

9 CHAIRMAN RAY: Well, no, no. I meant in
10 this instance only if the voltage goes up?

11 MR. CHOPRA: Yes.

12 CHAIRMAN RAY: If the generator excitation
13 is able to keep the voltage from going above the trip
14 point, it'll stay connected?

15 MR. CHOPRA: Right.

16 CHAIRMAN RAY: Okay.

17 MR. CHOPRA: And actually this wasn't a
18 open item, the next one, but we were really concerned
19 because the DCDs in AP1000 design battery chargers and
20 the voltage regulating transformers are being used as
21 a isolation device. In other words, if there is any
22 fault on the input of the battery charger, the battery
23 charger will limit the current to an acceptable value
24 and so would the regulating transformers. However, we
25 did not see this as a interface item or a COL action

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1 item. So, we requested Westinghouse to make this
2 particular item as a COL action item so all COL
3 applicants will periodically test these devices to
4 make sure that they're current limiting
5 characteristics are okay.

6 MEMBER BROWN: So, you're talking about
7 the battery charger itself being used to limit the
8 current due to any transient spike due to a rapid load
9 loss --

10 MR. CHOPRA: Right.

11 MEMBER BROWN: -- on the main station?

12 MR. CHOPRA: Or any other condition. If
13 there is a fall --

14 MEMBER BROWN: And then it would go to
15 zero if you have a short somewhere.

16 MR. CHOPRA: Right, but what I'm saying is
17 in case of a fall, the fall current will not
18 propagate. It will act as a isolation device. So, I
19 IEEE standard really allows them use them as isolation
20 devices, but they also say that if you're using them
21 as a isolation devices, they must be periodically
22 tested. So, that part was not a interface COL action
23 item or an interface item. So, they are going to
24 change their DCD and they have already made a COL
25 action item. I guess that's --

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1 MR. JAFFE: The information item. Well,
2 that's the information that didn't appear in 17, but
3 will appear with 18.

4 CHAIRMAN RAY: Okay. Well, that seems
5 like a prudent action.

6 MR. JAFFE: Yes.

7 CHAIRMAN RAY: Okay. Anything else?

8 MR. JAFFE: That's it.

9 MEMBER BROWN: Voltage regulating
10 transformers normally have some type of capacitive
11 devices in them, you know, with some resident-type
12 thing to allow them to regulate. I presume that's why
13 they're there, to regulate the AC output voltage.

14 MR. CHOPRA: Yes, they do. We really
15 do --

16 MEMBER BROWN: My point being is that
17 those can compromise your isolation in some
18 circumstances.

19 MR. CHOPRA: We really --

20 MEMBER BROWN: Because they're not used
21 everywhere, so I'm just --

22 MR. CHOPRA: Yes, I'm not really familiar
23 with this device. We don't know what kind of
24 regulating transformer --

25 MEMBER BROWN: Does it say regulating

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1 transformers?

2 MR. CHOPRA: Yes.

3 MEMBER BROWN: Okay.

4 MR. CHOPRA: Yes.

5 MEMBER BROWN: Interesting. All right.

6 CHAIRMAN RAY: All right. Thank you.

7 MR. JAFFE: Thank you.

8 CHAIRMAN RAY: All right. So, that
9 completes our review of the final SER for Chapters 7
10 and 8.

11 The agenda, Eileen, shows Chapter 13 staff
12 discussion.

13 MS. McKENNA: Yes.

14 CHAIRMAN RAY: Is that what you'd like to
15 do now?

16 MS. McKENNA: Yes.

17 CHAIRMAN RAY: Or you want to take a
18 break, or what?

19 MS. McKENNA: Well, I think the 13 could
20 be relatively short, so maybe we do that and then we
21 might take a break.

22 CHAIRMAN RAY: Fine. And then we'll have
23 the action items after that.

24 MS. McKENNA: Right. Right.

25 CHAIRMAN RAY: And that can be open ended.

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1 MS. MCKENNA: Right, and there are some
2 other possibilities that we could do this afternoon,
3 too.

4 CHAIRMAN RAY: All right. Good.

5 MS. MCKENNA: I have with me Perry
6 Buckberg who is the lead project manager for Chapter
7 13. I started to say, in our memo over to you we'd
8 indicated that we didn't think Chapter 13 warranted a
9 full presentation based on its content, but we wanted
10 to offer the opportunity obviously for the committee
11 to ask any questions they might have about that. So,
12 let me turn it over to Perry.

13 MR. BUCKBERG: Good afternoon. Hi, my
14 name is Perry Buckberg. I'm the project manager for
15 Chapter 13 and in Eileen's branch.

16 And Chapter 13 was first issued as about a
17 five-page document that had to do with such subjects
18 as the renaming of the TSC, the Tier 1 to Tier 2
19 change to control the TSC location, and items of that
20 depth. The issued Chapter 13 that just went out
21 within the last couple of months includes ITAAC
22 related to physical security, vital equipment list,
23 access control, detection and assessment systems,
24 communication requirements and such issues as that.
25 We've dealt with target sets, fields of fire having to

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1 do with intrusion into the grounds. And mainly it's
2 to do with the physical makeup of the plant, the
3 arrangement of the buildings and how it could be
4 secured. Most of the content of that evaluation is
5 going to be in an SGI document and the SER itself is
6 extended about 10 pages to include a description of
7 those ITAACs.

8 So, that's the overall scope of Chapter 13
9 which is titled again "Emergency Planning" and not
10 really very related to safety in its entirety.

11 CHAIRMAN RAY: I'm not sure what you meant
12 by that last statement.

13 MR. BUCKBERG: Its physical security has
14 to do with the security of the plant --

15 CHAIRMAN RAY: Okay. All right.

16 MR. BUCKBERG: -- and emergency planning,
17 not the systems within the plant so much and their
18 operation.

19 CHAIRMAN RAY: Yes.

20 MS. MCKENNA: We weren't trying to say
21 that emergency planning is not related to safety.

22 CHAIRMAN RAY: That's what it sounded
23 like. Okay.

24 MR. SISK: Mr. Chairman?

25 CHAIRMAN RAY: Yes?

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1 MR. SISK: Rob Sisk, Westinghouse. I just
2 wanted to get back to the question about the citation
3 in Chapter 14.

4 CHAIRMAN RAY: I think I found it.

5 MR. SISK: If you go to 14.2.9.1.14.

6 MEMBER BROWN: Yes, I got it.

7 MR. SISK: Okay.

8 MEMBER BROWN: Thank you. I was going to
9 tell you you didn't have to do that.

10 MR. SISK: There's quite a --

11 MEMBER BROWN: No, it looks pretty good.

12 CHAIRMAN RAY: Okay.

13 MEMBER BROWN: That's cleared.

14 CHAIRMAN RAY: With that distraction,
15 let's continue this discussion here for another
16 minute.

17 You refer to ITAAC and would it be your
18 view that you have specific objective inspection
19 criteria for the closure of those ITAAC; I'm
20 differentiating it from DAC now, already established
21 and it's just a matter of making up the inspection
22 requirements and going out and doing it?

23 MR. BUCKBERG: Yes, we'd agree with that.

24 MS. McKENNA: Yes, I think as an example
25 there's one on like bullet-resisting, you know,

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1 enclosures. It's not a DAC. I mean, the certain
2 capability that it has to have. Now, we have to be
3 carefully worded obviously because of the safeguards
4 nature, but these are physical security hardware
5 ITAAC, and they are very specific to some of the
6 things Perry mentioned, like the access controls,
7 communications and things like bullet-resisting.

8 CHAIRMAN RAY: Okay. Anybody have any
9 other questions on Chapter 13?

10 (No audible response.)

11 CHAIRMAN RAY: All right. Then we'll
12 check that off on the list.

13 We're going to now take a break until 20
14 minutes to 3:00, fifteen minutes, at which time we
15 will then do everything else that we can do before the
16 end of the day that's ready to be done, trying to move
17 this ball along.

18 Twenty minutes to 3:00, please.

19 (Whereupon, at 2:25 p.m. off the record
20 until 2:48 p.m.)

21 CHAIRMAN RAY: Okay. Let's come back on
22 the record here. As I've been chastened to observe,
23 we're late getting back to work. But on the other
24 hand, we will quit on time, if not before, today.

25 What caused the break to be longer than I

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1 thought it would be was we were talking about various
2 things that have to be shuffled around here.

3 Eileen, what is it that you would suggest
4 that we take up between now and the end of the day?

5 MS. McKENNA: Okay.

6 CHAIRMAN RAY: Just give me a list and
7 then --

8 MS. McKENNA: Okay. There are two
9 possible agenda topics we could cover this afternoon.

10 We could talk about action items in general, where we
11 are with them. We do have some time on the agenda
12 tomorrow, but I think tomorrow is probably going to be
13 more busy than today. So, that would be a possible
14 topic that we could talk about.

15 The other thing is that we are prepared to
16 begin the Chapter 18 applicant presentation this
17 afternoon if there's a sufficient block of time that
18 we can cover that material. And by that, I mean like
19 a good hour or so that is available, not 10 minutes,
20 to give us a little more flexibility tomorrow because
21 I think we may be a little pressed for time.

22 CHAIRMAN RAY: All right. Those are good
23 suggestions. And so, can you be ready to take up 18
24 if we can march through the action items?

25 MS. McKENNA: I believe Westinghouse has

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1 the right people in the room.

2 CHAIRMAN RAY: How about you guys?

3 MR. SISK: Yes, sir, we're ready to do 18
4 this afternoon if time permits.

5 CHAIRMAN RAY: All right. Fine. Weidong,
6 John Stetkar or Dennis Bley aren't going to be here,
7 either one?

8 MR. WANG: I'm not sure, but I know Sam --

9 CHAIRMAN RAY: Bley is not going to be,
10 I'm sure.

11 MR. WANG: Sam was going to come here
12 tomorrow.

13 CHAIRMAN RAY: Sam is the only one. We're
14 just looking at it from the standpoint of members who
15 have particular expertise in human factors.

16 Okay. Now, Eileen, before we go to
17 reviewing the action items, you heard what I said
18 about -- well, I'm going to just call them for
19 shorthand the U.K. items -- before.

20 MS. McKENNA: Yes.

21 CHAIRMAN RAY: And in we're still sort of
22 in the mode in which our best judgment is and what
23 we've heard from the staff and certainly from the
24 applicant is that these issues do not bear on the
25 amendment and we'll accept that as the tentative view.

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1 MEMBER BROWN: Is that on the U.K. issue?

2 CHAIRMAN RAY: Yes.

3 MEMBER BROWN: Oh, we're back on that
4 again? Okay. I lost the connection. Yes. Pardon
5 me, Harold.

6 CHAIRMAN RAY: That's all right. Just
7 trying to get my train of thought.

8 So, what we do want to do though, Eileen,
9 is to decide at what pace we might and over what
10 period of time we might anticipate; and we're
11 presently thinking of a joint meeting with our Digital
12 I&C subcommittee -- might hear the staff's views on
13 this. And we're not pressing you to give us a date
14 right now, but perhaps by the end of the day tomorrow
15 you could tell us. And for management's purposes you
16 can be assured that we want to hear from the staff of
17 your views, and not just about the nature of the
18 question, but about what your assessment is, maybe not
19 with final conclusions given the circumstances that
20 relate to the certification of the design. In other
21 words, this is where we end up, but at least with
22 enough meat on the bones that we can form some view
23 ourselves.

24 So, give us a time when we could do that,
25 a time frame, not sooner than, for example, or

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1 whatever. And then we'll try and include that in our
2 overall planning process. Okay?

3 MS. McKENNA: I will take that back to
4 some of my colleagues to discuss.

5 CHAIRMAN RAY: Fine.

6 MEMBER BROWN: The I&C subcommittee
7 meeting on the U.K. issue?

8 CHAIRMAN RAY: Yes, a joint meeting,
9 because --

10 MEMBER BROWN: With the --

11 CHAIRMAN RAY: AP1000. Yes, that's right.
12 Joint meeting. And so, this is the kind of thing.
13 And again, you can assure management that we will be
14 very definite about our desire to talk with the staff
15 about this. Okay?

16 MS. McKENNA: Yes.

17 CHAIRMAN RAY: All right. I think that
18 takes care of the housekeeping issues.

19 Oh, maybe I should direct a question here,
20 Ed, to you. Another subject has come up. We're
21 anticipating the review of the shield building at the
22 subcommittee meeting in November. I just became aware
23 here of the impact of the design on airflow. I'm not
24 talking about water now, which we'll talk about
25 tomorrow, I think. But basic thermodynamics of the

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1 heat removal from the containment and how that's
2 affected by the change in the shield building design.

3 Is that going to come along with the discussion of
4 the shield building itself?

5 I guess I should direct this both to
6 Eileen and to you, but I already have asked Eileen, so
7 let me ask you.

8 MR. CUMMINS: Ed Cummins. I don't know.
9 I think it fits probably best with Chapter 6 because
10 it's containment cooling.

11 CHAIRMAN RAY: Okay.

12 MR. CUMMINS: And it's a minor impact, but
13 we did do the analysis all over again and there's a
14 little bit less cooling because of the airflow.

15 CHAIRMAN RAY: Yes, we've noted that and
16 want to ask questions about it and so on. So, it will
17 be coming up with Chapter 6.

18 MS. McKENNA: Could I comment on that?
19 The Chapter 6 SER that we just sent you does not
20 include the staff's conclusions on that point. It
21 will be coming in November, not necessarily as part of
22 the shield building discussion, but at the same time
23 when we do what we call this Chapter 23, which is some
24 of these additional changes. The Westinghouse
25 document that Ed was referring to is available. That

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1 can be made available now to help, you know, when
2 the --

3 CHAIRMAN RAY: Well, I don't know that we
4 want to discuss it with Westinghouse in Chapter 6.

5 MS. McKENNA: No, I wasn't proposing we
6 discuss it with Chapter 6. I was just giving you the
7 situation of when we will have the staff's evaluation
8 to be able to discuss it with everybody concerned.

9 CHAIRMAN RAY: Okay. Well, let's stop for
10 a second. I thought you were suggesting it come with
11 Chapter 6.

12 MR. CUMMINS: That's what I thought was
13 best.

14 CHAIRMAN RAY: All right.

15 MR. CUMMINS: But it could be 23 if that's
16 better for you.

17 CHAIRMAN RAY: Well, really, I got to look
18 at these two guys over here. They were thinking that
19 we were going to do it as part of Chapter 6, right?

20 MEMBER BANERJEE: Well, if we don't have
21 the --

22 CHAIRMAN RAY: We need the staff's review,
23 is the problem.

24 MR. CUMMINS: That item only, I guess, but
25 I don't know.

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1 CHAIRMAN RAY: Is that what you're saying,
2 Eileen?

3 MS. McKENNA: It has not yet been
4 completed and issued as an SER.

5 MEMBER BANERJEE: So, by November it will
6 be though?

7 MS. McKENNA: Yes.

8 MEMBER BANERJEE: So, let's do it then.

9 CHAIRMAN RAY: All right. November.
10 Follow that, Weidong?

11 MR. WANG: Yes.

12 CHAIRMAN RAY: All right.

13 CHAIRMAN RAY: Okay. We're ready now to
14 take up action items, which means to me anyway that
15 that's something that you and Eileen lead the
16 discussion of and everybody gets their action items in
17 front of them.

18 MS. McKENNA: Right. I think part of this
19 is to again make sure these are still the items the
20 committee is interested in. And, you know, if we have
21 any questions about exactly what it's going to take to
22 respond to the items that there would be that
23 opportunity to get that kind of clarification.

24 CHAIRMAN RAY: Okay. Well, the first one
25 on my list is 2. Is that right?

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1 MS. McKENNA: Correct.

2 CHAIRMAN RAY: Okay.

3 MS. McKENNA: And we can give some
4 indication of when we expect that -- because some of
5 these very tied to chapters and would come when the
6 chapters come. Others are a little more of interest,
7 but they don't directly bear on information in the
8 design cert amendment, so we will decide then when we
9 can fit them in and we have the right people available
10 to do that.

11 The first one, there was a presentation
12 last year about what they were doing about the generic
13 letter 2008 in terms of adding vents to various places
14 in the piping. We have their submittal on that. This
15 is one that we will be issuing the SER in October for
16 a November discussion.

17 CHAIRMAN RAY: Okay. That's item 2?

18 MS. McKENNA: Item 2. Item 4 on the
19 reactor coolant pump flywheel is part of our Chapter 5
20 discussion and we will be covering that tomorrow.

21 CHAIRMAN RAY: And Sam will be here for
22 that.

23 MS. McKENNA: Right.

24 CHAIRMAN RAY: Okay.

25 MS. McKENNA: Item 6 we talked about a

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1 little earlier today. And, Rob, did you want to say
2 anything more about if and when there's other
3 information you would want to offer on this one?

4 MR. SISK: We're going to talk briefly
5 about it tomorrow.

6 MS. McKENNA: Okay.

7 MR. SISK: In the Chapter 5 discussion.

8 CHAIRMAN RAY: Talking briefly about it,
9 does that mean you envision closing it then, or --

10 MR. SISK: Yes, sir. In talking to the
11 subject matters, we believe we've addressed these
12 questions, but if we're wrong or there's additional
13 questions or clarity, then we'll obviously want to
14 clear that up.

15 CHAIRMAN RAY: All right.

16 MS. McKENNA: This is one, No. 10, whether
17 there was -- I know there was a question about how the
18 uncertainties were combined and there was a textbook
19 or other references. And I think this was Dr.
20 Banerjee's question. Is there something you're
21 looking for here?

22 MEMBER BANERJEE: Well, I was just asking
23 for a reference on that.

24 MS. McKENNA: Yes, and I --

25 MEMBER BANERJEE: It was provided.

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1 MS. McKENNA: It was? Okay. So, was this
2 open, closed?

3 MEMBER BANERJEE: I think Graham took a
4 look at this, right? What was your conclusion?

5 DR. WALLIS: Well, we haven't heard yet
6 what the Westinghouse method is.

7 MR. WANG: Westinghouse has't provided us
8 the reference yet.

9 CHAIRMAN RAY: Well, wait a minute. I'm
10 hearing two different things.

11 DR. WALLIS: It's not my job to do that
12 job, is it?

13 MEMBER BANERJEE: But didn't this --

14 DR. KRESS: They said they used the
15 inverse square, and that's almost sufficient for me to
16 say that's an acceptable way to do this.

17 MEMBER BANERJEE: But they were going to
18 provide a reference.

19 DR. KRESS: Yes, we got a reference. I
20 don't know where it came from.

21 MEMBER BANERJEE: I thought they gave us a
22 reference.

23 DR. KRESS: Pardon?

24 MEMBER BANERJEE: I thought they did.

25 DR. WALLIS: You can do certain forms of

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1 the physical distribution. You cannot do bias and you
2 cannot do normal. So, we're just limited, but they
3 work for certain --

4 DR. KRESS: Yes, you have to assume the
5 distribution for the uncertainties, but --

6 DR. WALLIS: And no bias, right?

7 DR. KRESS: No bias. That's right. But,
8 you know, I think it's appropriate for this.

9 DR. WALLIS: But we haven't had any change
10 to see what their basis is and to question them about
11 it.

12 MEMBER BANERJEE: So, if I remember,
13 Graham wrote a paper on this, which we got a copy of,
14 which he showed for a Gaussian distribution without
15 bias it works.

16 DR. KRESS: It doesn't really have to be a
17 Gaussian, but if you know the distribution you can do
18 it. But that's an appropriate assumption.

19 DR. WALLIS: It cannot be flat. It
20 doesn't work.

21 DR. KRESS: It can't be flat. But the two
22 can -- you can approximate the distribution with a
23 Gaussian and you'll get close enough.

24 MEMBER BANERJEE: But if there's an bias,
25 how is that --

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1 DR. KRESS: If there's any bias, you don't
2 get that all.

3 DR. WALLIS: So, what's Westinghouse's
4 claim and what does the staff think about it? I think
5 we ought to know that before we decide how we would
6 desire it.

7 DR. KRESS: We probably need to hear that.

8 CHAIRMAN RAY: The problem we have here is
9 that I don't think we understand what the question is.
10 Sometimes it sounds like it's been answered and
11 sometimes not. So, let's try again. We were supposed
12 to get a reference; we got a reference, but the
13 reference doesn't --

14 MEMBER BANERJEE: We looked at it.

15 CHAIRMAN RAY: Okay.

16 MEMBER BANERJEE: Graham did an analysis.

17 CHAIRMAN RAY: Right. Now, what is it
18 that we would like to see in order to close the issue?
19 Don't all speak at once.

20 MEMBER BANERJEE: Well, I think -- has
21 Graham's paper been made available to the staff?

22 MR. WANG: My memory tells me I think in
23 during the meeting --

24 MEMBER BANERJEE: We asked for a
25 consultant report, right?

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1 MR. WANG: Yes, during the meeting they
2 said they are going to provide us a even textbook
3 reference. And then we put on this action items and I
4 think we pass it, but I never did receive these
5 reference.

6 MEMBER BANERJEE: So, what happened was I
7 thought we were provided. Graham did -- you know, my
8 memory doesn't function fully, but we got enough
9 information that we could do our own analysis of it.
10 So, we had Graham do a consultant's report on it. He
11 wrote a report, which we received. And then it showed
12 some sort of behavior. Within a certain restricted
13 set of circumstances the method worked and in
14 different circumstances it did not. I think what to
15 close the loop it would be useful to us to know that
16 the methodology that Westinghouse proposed; and this
17 is really to the staff, falls within the category
18 where the method really works. I mean, the method
19 does work for non-biased normal or other distributions
20 which can be approximated by a normal -- for a normal
21 distribution, right? If it can be shown that this is
22 true, then the matter is closed.

23 DR. WALLIS: Only if you can show that the
24 measurements such as the delta P calculation for the
25 core as no bias. I mean, there are certain

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1 qualifications. I think Westinghouse needs to declare
2 what the basis for their claim is, explain it and then
3 the staff needs to review it, and then they need to
4 come to us with a case. Otherwise, we're speculating
5 about what the method might be.

6 MEMBER BANERJEE: And certainly we have no
7 objection at all to the staff having access to our
8 consultant reports. In fact, this is also true for
9 GSI-191.

10 CHAIRMAN RAY: supervisor So, what we're
11 talking about is the statistical method of combining
12 diverse measurements and what is -- the action item
13 was provided a reference. But what we're saying now
14 is --

15 MEMBER BANERJEE: We got it. We analyzed
16 it.

17 CHAIRMAN RAY: -- got it, analyzed it and
18 now there's something more needed, which is -- as I
19 understand Graham, it's to justify what they do and
20 have the staff review it. But what would you do with
21 Graham's analysis?

22 DR. WALLIS: Well, I had a preliminary
23 assessment.

24 MEMBER BANERJEE: Either it's right or
25 wrong to begin with. Okay. We start with that.

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1 Westinghouse may or may not agree with the analysis
2 that was done, or the staff may or may not agree. It
3 doesn't matter, one or the other.

4 CHAIRMAN RAY: All right.

5 MEMBER BANERJEE: Second, if they agree,
6 then the analysis shows that the methodology only
7 works under a restricted set of circumstances. And we
8 then need to show that the measurements or the way
9 they were combining it or whatever meet these
10 restrictions. If it does, it's fine.

11 CHAIRMAN RAY: Okay. Take the --

12 MEMBER BANERJEE: I think it's exactly
13 what we need in these three steps. One, is it
14 correct? Could be wrong. Graham, even though he's
15 very, very smart, is not infallible.

16 DR. WALLIS: But we don't yet know what
17 Westinghouse's rationale is and whether it has
18 limitations and so on. So, we need to know that. I
19 think we need a presentation.

20 MEMBER BANERJEE: It is a very important
21 matter, I would say.

22 CHAIRMAN RAY: Nobody's trying to diminish
23 the importance of it. I'm just trying to figure out
24 whether to take what was done as you suggest, Sanjoy,
25 have Weidong give it to the staff and ask them to

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1 interface with Westinghouse if they wish, but in any
2 event tell us what they think. That's one thing.
3 That's what I hear you saying.

4 A different approach is to say, well no,
5 we need the applicant to -- leaving aside his
6 analysis, to justify what they've done. Give that to
7 the staff and have the staff then tell us what they
8 think of it. Those are to me two different --

9 MEMBER BANERJEE: Well, the applicant
10 already has submitted something which has come to the
11 staff.

12 CHAIRMAN RAY: Right.

13 MEMBER BANERJEE: Staff has made a
14 presentation to us. We have asked for some
15 information. We've done our own analysis. I think we
16 should give it back to the staff. Ask for their
17 comments.

18 CHAIRMAN RAY: Fine. So be it.

19 DR. WALLIS: You can't license based on
20 the analysis of a consultant or ACRS. You have to
21 license based on what Westinghouse submits.

22 CHAIRMAN RAY: What we're going to do --
23 we certainly aren't going to do anything other than
24 that, but what we're going to do about this, which is
25 a separate matter, is to do as Sanjoy asked. Take the

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1 report, give it to the staff, ask them if they would
2 please tell us what their view is, recognizing that we
3 believe the matter is not yet resolved. They may then
4 decide to ask Westinghouse for something more.

5 MR. CUMMINS: Ed Cummins. I think, you
6 know, if we need to comment on that, we need to see
7 it.

8 CHAIRMAN RAY: Well, that's up to the
9 staff, Ed.

10 MR. CUMMINS: Okay.

11 CHAIRMAN RAY: Okay. Eileen, proceed.

12 MS. McKENNA: Item 11. We have a
13 subcommittee meeting early November on -- aircraft
14 impact was part of a Chapter 19 presentation and does
15 include a presentation on the assessment itself that
16 will be done by the applicant, and obviously that part
17 of the presentation will certainly be closed.

18 CHAIRMAN RAY: We'll have a day for ACRS
19 members prior to the meeting to review information
20 made available to us.

21 MEMBER BANERJEE: When is that going to
22 be?

23 CHAIRMAN RAY: The 1st, I believe. I
24 think it's November 1st.

25 MS. McKENNA: The review day would be

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1 November 1st, because the briefing day is November
2 2nd.

3 CHAIRMAN RAY: There's a subcommittee
4 meeting taking place that same day, but during breaks
5 -- you'll have to take advantage before the meeting.
6 Dennis wanted to review it before the 8:30 start time.

7 MEMBER BANERJEE: So, it will be available
8 on the 1st?

9 MS. McKENNA: Yes, I have to check with
10 Westinghouse exactly what time.

11 MEMBER BANERJEE: Second there is a --

12 CHAIRMAN RAY: It'll be presented here in
13 a closed meeting.

14 MS. McKENNA: Right.

15 MEMBER BANERJEE: But there's also another
16 meeting, isn't there?

17 CHAIRMAN RAY: Oh, God, I don't -- you
18 have the advantage of me, Sanjoy.

19 MEMBER BANERJEE: Well, that's not their
20 concern here. It's ours.

21 CHAIRMAN RAY: Yes.

22 MEMBER ABDEL-KHALIK: The important thing
23 is that the material will be made available to ACRS at
24 least a day ahead of time.

25 MS. McKENNA: Yes.

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1 MEMBER ABDEL-KHALIK: Okay. Thank you.

2 MS. McKENNA: The next item I had was PRA
3 information. And, you know, we provided documents and
4 we will be coming back in early November with our
5 finalization of Chapter 19. So, I don't know if
6 there's any specific items/questions any members have
7 here based on the information that's already been
8 provided. May not be many in the room, I realize
9 this. So, I don't have anything more to say on that
10 one.

11 CHAIRMAN RAY: Are we on 27?

12 MS. McKENNA: On 27.

13 CHAIRMAN RAY: Yes. I'm sorry, I was
14 still trying to --

15 MS. McKENNA: It's okay.

16 CHAIRMAN RAY: -- resolve what to do about
17 aircraft impact over here.

18 MS. McKENNA: Yes. So, then 32 obviously
19 went with this morning's discussion on the I&C
20 architecture.

21 CHAIRMAN RAY: Excuse me, Eileen. On 27,
22 Weidong, do we know what the status of member --

23 MR. WANG: Basically staff provide us the
24 audit report and I have distribute to the members.

25 CHAIRMAN RAY: All right.

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1 MR. WANG: But since then, basically we
2 need it -- they are coming back again in November, as
3 Eileen said, and if there's any questions we can ask
4 them although it has been closed.

5 CHAIRMAN RAY: Well, all right. But I
6 don't want then for people to say well I didn't know
7 that I needed to be ready to sign off on this thing.
8 So, let's make sure we tell everybody, particularly
9 those concerned that -- bring their attention to the
10 distribution and the fact that this thing is going to
11 be closed.

12 Okay, Eileen. Go ahead.

13 MS. McKENNA: Okay. As I said, we talked
14 about 32 this morning and I think I know or I will
15 know by the end of the day whether there's any follow-
16 up items on the architecture and --

17 MEMBER BROWN: Well, the high speed link
18 issue --

19 MS. McKENNA: And the high speed link.

20 MEMBER BROWN: -- that's where I said you
21 all sent me the information, high speed link issue is
22 closed. The architecture part, is that okay?

23 MR. WANG: You said architecture part --

24 MEMBER BROWN: The high speed link
25 questions, those were answered satisfactorily. I went

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1 through the open items that the staff had and the
2 resolution in that report, and they looked
3 satisfactory to me on the high speed link.

4 CHAIRMAN RAY: So just to be clear, item
5 32 is closed?

6 MEMBER BROWN: No, the high speed link
7 part of 32 is closed.

8 CHAIRMAN RAY: That's what I was confused
9 by. Go ahead.

10 MEMBER BROWN: Okay. And it's going to be
11 up to the committee to tell me to pound sand whether
12 all the architecture issue is closed. The
13 independence part of it is not explicitly noted. The
14 conversation identified why they think it's
15 independent. It's not embodied in the DCD explicitly
16 nor in 16675 in terms of the discussion, similar to,
17 you know, why-is-this-independent-type thing? What do
18 we want to do with that? So, I mean, that's to me
19 how does the committee handle those in the long
20 picture?

21 The determinant discussion. In terms of
22 the processing, the CR, CON, TRNs and how they're --
23 and the timing cycles and a discussion of why those
24 end up being determinant, because again an interrupt
25 system is not inherently determinant. And they had a

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1 much better discussion than what's contained in either
2 the Common Q platform or whether there was more detail
3 on it. So, what do we do with that? In other words,
4 justification is not contained in the documentation
5 that we reviewed.

6 CHAIRMAN RAY: All right. This almost
7 sounds like it has a generic character; that is to say
8 it's a principle rather than -- I'm just wondering if
9 the --

10 MEMBER BROWN: Well, I would tell you the
11 class of some of the other projects as well, yes, but
12 this is the specific one we have to deal with right
13 now.

14 CHAIRMAN RAY: Absolutely right.

15 MEMBER BROWN: That's why I bring it up
16 now.

17 CHAIRMAN RAY: All I'm saying is though
18 that is this something that ought to be discussed in
19 the Digital I&C Committee so we don't have one-off
20 positions taken?

21 MEMBER BROWN: I don't know. I don't now
22 why the issue is an issue. I mean, I think it's
23 really going to come down to where we go relative to
24 the DCD and other type of information that's provided.

25 CHAIRMAN RAY: Let me say it this way:

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1 This sounds to me like something that should be
2 discussed with the Digital I&C Committee just so all
3 the people who will be --

4 MEMBER BROWN: Well, we ought to have all
5 the people on the committee, yes. I wouldn't want to
6 try to dictate anything with me alone, no. But Dennis
7 and John --

8 CHAIRMAN RAY: Yes, so once again, let's
9 set this for a Digital I&C Committee meeting at the
10 earliest time possible. Because when you say "we," as
11 you just said yourself, it means more than yourself.

12 MEMBER BROWN: Yes, yes, yes, yes.

13 CHAIRMAN RAY: And so we need to somehow
14 engage them. And rather than expecting them to show
15 up here again and, you know, just say, ah, you're
16 here, good, let's talk about it, let's see if we can't
17 get the issue taken up there, because I think that
18 would be the best place to get a common view of those
19 who are concerned. Okay?

20 MR. CUMMINS: So, this is Ed Cummins.
21 This one sounded difficult to me and I would say that
22 if you need some additional documentation from
23 Westinghouse in some form like a technical report, if
24 you would help us narrow the scope of it, we can help
25 by creating something that we could give to the staff

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1 and to the ACRS. If the concern is that the
2 information is missing, then we can handle that part
3 of it if we know what you need.

4 CHAIRMAN RAY: Okay. That's appreciated,
5 Ed. I think it may also be in everyone's interest if
6 we can find a time when the right people are
7 available; and again, I envision it as having
8 implications to more than just this, that you guys
9 could come and make your case. Because if I
10 understand Charlie correctly, it's the others who have
11 expertise in this area who need to hear the story and
12 discuss it among themselves and come to a conclusion,
13 and your input at that time would be valuable, if it
14 works.

15 So in any event, we're not going to get it
16 resolved here, I don't think, and you wouldn't want
17 to, Charlie.

18 MEMBER BROWN: Oh, and the watchdog timer
19 thing. What does it do and how does it do it? I
20 haven't gone off and looked at the thing based on the
21 conversation we had to today.

22 CHAIRMAN RAY: All right. So this remains
23 -- I lost track of where the heck I am now.

24 So, yes, should we make it a new item
25 though just so we don't --

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1 MEMBER BROWN: No, we can close this and
2 make it a new item and it's just fundamentally -- it's
3 coming down to where in the DCD and/or -- where in the
4 information train as opposed to just conversations,
5 discussions on how things are supposed to work.

6 CHAIRMAN RAY: All right. Well, it
7 sounded to me like it also involved some substance as
8 opposed just to where the information resided. Your
9 first discussion indicated to me that there was a real
10 issue, a technical issue that had to be resolved as to
11 what represented an adequate design.

12 MEMBER BROWN: The determinant
13 communication aspect of it --

14 CHAIRMAN RAY: Yes.

15 MEMBER BROWN: -- is dependent upon
16 loading.

17 CHAIRMAN RAY: Yes.

18 MEMBER BROWN: A point that was made. And
19 you think about it, if you make changes later because
20 somebody wants to incorporate another function or
21 process control module into the software, now you are
22 loading it additionally again. You're adding to the
23 load that the processor has to handle. That's why in
24 lines you just can't keep adding stuff to it because
25 pretty sure you run out of bandwidth. Same thing

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1 happens here.

2 CHAIRMAN RAY: Well, all right.

3 MEMBER BROWN: So, you need to document
4 that, that's all, somehow, why in this application the
5 number of control modules and what it looks like. And
6 they've got these other safeguards that aren't
7 discussed clearly anyway.

8 CHAIRMAN RAY: Well, all right. Just bear
9 in mind that the applicant is offering to provide any
10 additional information that would be helpful in
11 resolving this for us, and we should ask them if there
12 is information that we could use that for. But I
13 still think you are craving a discussion among your
14 peers on the committee who have --

15 MEMBER BROWN: I don't know whether Dennis
16 and John would agree with me or not.

17 CHAIRMAN RAY: Yes.

18 MEMBER BROWN: So, that's the purpose of
19 having other folks.

20 CHAIRMAN RAY: Usually that's helpful to
21 talk to others who know what you're talking about.

22 MEMBER BROWN: That's why I have Myron
23 here today.

24 CHAIRMAN RAY: Yes, all right.

25 MR. CUMMINS: We could even have

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1 participation on a conference call, or whatever we
2 could do to help.

3 CHAIRMAN RAY: All right. Thank you.

4 MEMBER BROWN: We'll work that out. If
5 you want to make it a separate --

6 CHAIRMAN RAY: Well, I'm worried about the
7 calendar. Anyway, so, let's make a new item out of
8 it, Weidong. Let's close this item.

9 Thirty-three-Eileen.

10 MS. McKENNA: Okay. Thirty-three.

11 MEMBER BROWN: No, it was 32.

12 CHAIRMAN RAY: No, I said go onto 33.

13 MEMBER BROWN: Oh, okay. Sorry.

14 MS. McKENNA: I think this was more of a
15 general item, when we have changes to methods to be
16 sure to flag them so that the committee can see what
17 they are and be able to speak to them. And so, it's
18 not a specific presentation item. It's more as we go
19 when particular method changes appear.

20 CHAIRMAN RAY: Said, you have any comment?

21 MEMBER ABDEL-KHALIK: No. No, the
22 specific example that they give here is an example
23 where there was a method change and that was presented
24 to us. So whenever there is a significant change in
25 methods, I think we ought to hear about it. That was

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1 the point.

2 CHAIRMAN RAY: Okay. And so we should
3 just keep this open to remind us to do that?

4 MEMBER ABDEL-KHALIK: Right. But for that
5 specific example obviously was closed.

6 CHAIRMAN RAY: Yes.

7 MEMBER ABDEL-KHALIK: I think that it is
8 nothing but a placeholder to say future changes to be
9 highlighted. That's what it does.

10 CHAIRMAN RAY: All right. Go ahead,
11 Eileen.

12 MS. McKENNA: Thirty-four is a human
13 factors DAC and we will be discussing that with the
14 committee tomorrow, so I'll move on.

15 CHAIRMAN RAY: Looking forward to it.

16 MS. McKENNA: Thirty-five and the next
17 couple are all related to the GSI-191 and will be
18 covered at the October meeting.

19 The boric acid information is included in
20 one of the reference documents that I have given to
21 your staff.

22 The aluminum and concrete scouring and hot
23 leg break will be in the Chapter 6 SER. The
24 statistical analysis of fuel assembly tests, there was
25 a specific report prepared by Westinghouse that I also

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1 made available, so that information exists in the
2 reports. And as I say, some of these items we will be
3 discussing explicitly, like the concrete and the hot
4 leg break, at the October meeting.

5 MEMBER BANERJEE: Yes, I was just looking
6 through these reports. So, Harold, I think we will
7 need a full day.

8 CHAIRMAN RAY: On the 5th?

9 MEMBER BANERJEE: Yes.

10 CHAIRMAN RAY: All right.

11 MEMBER BANERJEE: We just got a sample of
12 one report and that already shows me the amount of
13 work.

14 CHAIRMAN RAY: Yes. Well, that's what I
15 anticipated, to be honest with you, so that's fine.

16 MS. McKENNA: Okay. Item 46 was a
17 question about how risk ranking was done on MOVs. And
18 this is one that's not really directly related to any
19 open items that we had and it will be one we will find
20 moving to -- I think we were thinking one of the
21 November meetings that we would cover this topic.

22 Forty-seven, we spent a lot of time on it
23 at an earlier meeting. This was whether the two
24 percent value that's assumed for power measurement
25 uncertainty, what it covers and doesn't cover. And I

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1 know there's been some other discussions that have
2 occurred. So, I don't know whether there's still --

3 MEMBER ABDEL-KHALIK: I think this item is
4 closed.

5 MS. McKENNA: Okay. Thank you.

6 MEMBER ABDEL-KHALIK: The staff reported
7 on this issue.

8 MS. McKENNA: I think they had some
9 discussions and -- yes.

10 And 48 again was not -- kind of came up in
11 our Chapter 15 discussion. Westinghouse, was this a
12 November one that -- or was this October you were
13 going to speak to? I don't remember right off.

14 MEMBER ABDEL-KHALIK: Which one is it, 48?

15 MS. McKENNA: Forty-eight, on the
16 interlocks for the ADS valves.

17 MR. WANG: They have addressed this one,
18 yes, because this one from February meeting, basically
19 talking about -- I think Chapter 15 for the safety
20 system analyses.

21 MS. McKENNA: Yes.

22 MR. WANG: I think one of the member ask
23 this ADS, you know, if there's more function or those
24 things, what's impacts. That's what your question is?

25 MS. McKENNA: Right. Again, at a future

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1 meeting we will have to find the right time to talk
2 about that. That may or may not be October, because
3 October's looking pretty busy.

4 MEMBER BANERJEE: I don't completely
5 understand. Is this from the point of view what is
6 the likelihood that these --

7 MS. McKENNA: Well, that was part of the
8 discussion, whether it was a design basis condition
9 that had to be considered and therefore you needed to
10 have a safety analysis to show it, or if there were
11 interlocks or other things that put it more into a
12 different kind of event.

13 MEMBER BANERJEE: Okay. So, who asked it,
14 was it Stetkar?

15 MS. McKENNA: I think it was Stetkar. I
16 don't have it written down here, but that's my
17 recollection.

18 CHAIRMAN RAY: Add that, would you please,
19 Weidong, just so we try and keep track of whose
20 questions we're looking --

21 MEMBER BANERJEE: You might ask Stetkar if
22 it was his question.

23 CHAIRMAN RAY: Yes, but at least let's
24 have a thread that we can pull on.

25 MS. McKENNA: The next two items were

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1 related to Chapter 15, again Dr. Banerjee's questions
2 about some of the code, ASTRUM, W/TRAC, and how they
3 apply to the AP1000. So, we can cover that when we do
4 Chapter 15 in October.

5 MEMBER BANERJEE: Which date in October
6 will that be?

7 CHAIRMAN RAY: Yes.

8 MS. McKENNA: That's the October 5th,
9 which is Chapter 6 and 15, and you're to be here
10 anyway for the GSI-191.

11 MEMBER BANERJEE: I don't think you're
12 going to have much time.

13 MS. McKENNA: We may run out of time, in
14 which case it would have to carry over to one of the
15 November days.

16 MEMBER BANERJEE: Yes, this is not a
17 question of the same importance as GSI-191.

18 MS. McKENNA: Yes. No, we're going to
19 float an agenda to Weidong later today, because we
20 want to make sure in October we really hit what the
21 committee wants to cover in October. So, we've
22 offered some topics and time scales and we'll try to
23 confirm that. And I do have 15 kind of at the end of
24 the day, and if that's what falls over to the next
25 meeting, then that may be what we have to do.

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1 MEMBER BANERJEE: This is more
2 informational really.

3 MS. McKENNA: Yes.

4 MEMBER BANERJEE: From what I see here.

5 CHAIRMAN RAY: All right.

6 MS. McKENNA: The next three --

7 CHAIRMAN RAY: Well, we will plan to have
8 a complete full day on the 5th, trust me.

9 MS. McKENNA: Oh, yes. And I'm sure it
10 will be a full day.

11 CHAIRMAN RAY: We will run -- nobody plan
12 to go to the airport at 5:00.

13 MS. McKENNA: Right.

14 MEMBER BANERJEE: Well, we have a full
15 committee.

16 PARTICIPANT: The same week.

17 CHAIRMAN RAY: I know that. That's why I
18 said --

19 MEMBER BANERJEE: So there's nobody going,
20 yes.

21 CHAIRMAN RAY: Well, there may be the
22 applicant maybe going to the airport.

23 MEMBER BANERJEE: Right.

24 MS. McKENNA: Okay. Then we have the next
25 three were shield building-related, so they will be

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1 addressed when we cut through the shield building
2 presentation in -- it's either 18th or 19th of
3 November. We haven't agreed on which day is going to
4 be which topics, but it will be that meeting.

5 Now, squibb valves is kind of one we'll
6 have to squeeze in somewhere. We don't have a --

7 MEMBER BANERJEE: Wasn't this answered
8 somehow, or was there --

9 CHAIRMAN RAY: No.

10 MEMBER BANERJEE: -- that they gave us
11 some information about it?

12 CHAIRMAN RAY: That's right.

13 MEMBER BANERJEE: And I think that was all
14 I had asked for. But then I think Charlie had some
15 other questions.

16 CHAIRMAN RAY: Referred to here as Member
17 Brow.

18 MS. McKENNA: Sorry, little typo there.

19 MR. WANG: Yes, right, it's a typo.

20 MS. McKENNA: And I have to apologize.
21 That occurred at a meeting that I wasn't present at,
22 so I don't have the memory of how --

23 CHAIRMAN RAY: Charlie, you still own that
24 one?

25 MEMBER BROWN: What are the --

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1 CHAIRMAN RAY: Details on how many tests
2 and what's the configuration of the upstream depth
3 of --

4 MEMBER BROWN: I have --

5 CHAIRMAN RAY: What?

6 MEMBER BROWN: I have no idea what that
7 is.

8 CHAIRMAN RAY: Yes, I don't remember that
9 being associated with you, to be honest with you.

10 MEMBER BROWN: I don't either.

11 CHAIRMAN RAY: Weidong, can you shed any
12 light on that?

13 MR. WANG: Well, I think that's what we
14 recorded from the transcripts.

15 CHAIRMAN RAY: Listen, if you're
16 satisfied, Sanjoy, let's close this, close 55.

17 MEMBER BANERJEE: In fact, my interest
18 arose because of something that I was simply inquiring
19 about, the question that arose in the --

20 CHAIRMAN RAY: All right. And 54 is still
21 listed here rather than among the closed items. Why?

22 MS. McKENNA: Well, it's crossed out, but
23 I think --

24 CHAIRMAN RAY: It should be taken out of
25 here and --

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1 MS. McKENNA: Yes, yes. I think it's
2 just --

3 MR. WANG: Containment code actually I
4 think -- yes.

5 MS. McKENNA: I mean, we will pick up flow
6 information tomorrow. Maybe that's why it was still
7 in here.

8 CHAIRMAN RAY: I don't know, but let's get
9 rid of it after this session.

10 MS. McKENNA: Okay. The next one I had
11 was there were some things from our Chapter 10
12 discussion on the over speed and the turbine sensors
13 and this monoblock turbine rotors. And I think we
14 provided the documents. I guess it's whether there's
15 -- I think there's this middle paragraph that still
16 needs to be responded to, I believe.

17 MEMBER BROWN: Okay. Well, I --

18 MS. McKENNA: And I understand, Mr. Brown,
19 you had some questions on the --

20 MEMBER BROWN: I provided comments --

21 MS. McKENNA: Yes.

22 MEMBER BROWN: -- on July the 10th?

23 MS. McKENNA: Yes.

24 MEMBER BROWN: Twentieth?

25 MS. McKENNA: Yes.

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1 MEMBER BROWN: Back through the staff.
2 There were three specific comments relative to the
3 stuff that's not in here and hadn't heard anything.
4 One of the -- just to give you a flavor, one of the
5 notes -- I read the RAI that Westinghouse provided,
6 the response the RAI. And if you look at the new
7 ITAAC, whatever you call it in here, there's a note in
8 one of these items that specifies that the overall
9 turbine speed -- you're supposed to ensure the speed
10 will not exceed 120 percent as stated in the DCT.

11 CHAIRMAN RAY: Well, wait, Charlie. Wait,
12 wait, wait.

13 MEMBER BROWN: Point being is they don't
14 do a timing analysis to show that it will respond.
15 So, I'm just saying those three points, none of those
16 have been addressed.

17 CHAIRMAN RAY: Eileen, do you acknowledge
18 the ball is in your court?

19 MS. McKENNA: Yes, yes. We have the --

20 CHAIRMAN RAY: All right. Let's move on.

21 MS. McKENNA: -- comments provided, yes.

22 Okay. Fifty-seven, it looks like that
23 one's our action to get back to you.

24 CHAIRMAN RAY: Does that look right to
25 you, 57, Charlie?

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1 MEMBER BROWN: Yes, I vaguely remember
2 this.

3 CHAIRMAN RAY: All right. Let's move on.

4 MEMBER BROWN: Nothing's been done with
5 it.

6 CHAIRMAN RAY: All right.

7 MS. McKENNA: Okay. Then a couple of
8 documents that were requested which have been
9 provided, so I'll skip over those.

10 CHAIRMAN RAY: Fifty-eight, what's the
11 story there, Weidong? Somebody need to answer this,
12 58?

13 MR. WANG: Did I crossed that?

14 MS. McKENNA: We comment that --

15 MR. WANG: Yes. Okay. Yes.

16 MS. McKENNA: -- to provide the document
17 with criticality analysis. Chapter 9 will be
18 discussed with the committee on November 3rd. So, if
19 there are questions on the criticality, the applicant
20 and the staff will be available at that time to talk
21 about that with Chapter 9.

22 MR. WANG: We crossed it because we
23 distributed. I think it's one of your CDs.

24 CHAIRMAN RAY: All right. But my point is
25 whoever's issue it was, you need to follow up and say

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1 did you look at this, is it okay, and then cross it
2 off.

3 MR. WANG: Okay. Yes.

4 CHAIRMAN RAY: Otherwise these things
5 build up.

6 Fifty-nine? Let's go.

7 MS. McKENNA: Okay. This was also a
8 provided document, so --

9 CHAIRMAN RAY: Okay. Some comment.

10 MS. McKENNA: Sixty is the one we'll be
11 talking about tomorrow.

12 MEMBER BANERJEE: How much time will you
13 be spending on this tomorrow?

14 MS. McKENNA: The agenda shows a half-an-
15 hour. I don't think that's enough. One of the
16 reasons why it was suggested we might want to start 18
17 today so we'd have more time tomorrow.

18 CHAIRMAN RAY: Yes, we're going to do 18,
19 because I'm going to get to the end of this here --

20 MS. McKENNA: Yes, we're almost done.

21 CHAIRMAN RAY: -- quickly as we can.
22 We'll do 18.

23 MS. McKENNA: We have then this item from
24 the consultant about the soil. We need to respond
25 back on that. It primarily affects the COL, so we'll

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1 have to consult with our COL people to provide a
2 coordinated response.

3 Sixty-three provided us with calculations
4 on the toxic gas and explosives --

5 MEMBER BANERJEE: We had --

6 MS. McKENNA: -- which I think you have.

7 MEMBER BANERJEE: -- Graham also do some
8 work on this.

9 MS. McKENNA: Okay.

10 MEMBER BANERJEE: And he turned out a
11 consultant report which I think we should forward to
12 you.

13 MS. McKENNA: On No. 63?

14 MEMBER BANERJEE: Yes.

15 MS. McKENNA: Okay.

16 MEMBER BANERJEE: Which, Weidong, can you
17 send it to them?

18 MR. WANG: Yes. All the report were enter
19 and I have --

20 MEMBER BANERJEE: Yes. So then, let's
21 keep that open until we hear back from you on that.

22 MS. McKENNA: Okay. Then the last one was
23 kind of from the same meeting about -- yes, and we can
24 get a response back either by Westinghouse or by the
25 COL of how the hydrogen is replenished and whether

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1 that contributes a larger supply of gas that could be
2 involved in handling and cause a problem. So, that's
3 an open item.

4 And one that kind of got dropped off of
5 this because of the way I -- when I printed out the
6 report the trip breakers had been item 41, had been
7 crossed off and then we talked about it today, and I
8 think it maybe is un-crossed off. So, just, you know,
9 as a reminder that that one we did have as an item and
10 it may be back. It's depending on the committee wraps
11 up at the end of the session.

12 CHAIRMAN RAY: Yes, now which one? You
13 called it 41, did you?

14 MS. McKENNA: Forty-one. And what happened
15 was it was crossed off actually in the last meeting I
16 guess and we either hadn't communicated that case
17 until Westinghouse discussed it.

18 CHAIRMAN RAY: Yes.

19 MS. McKENNA: And I wasn't sure of the
20 basis of the crossing off, because I wasn't --

21 CHAIRMAN RAY: All right.

22 MS. McKENNA: -- there when it happened.

23 CHAIRMAN RAY: Just leave it crossed off.

24 Weidong, I think we already said, but make
25 an item if you haven't. It belongs to Charlie. It

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1 has to do with the idea that reactor trip breaker
2 testing interval has been proposed or exists as a
3 result both of the design change and operating
4 experience with regard to breaker testing. And at
5 this point we don't yet have a resolution of whether
6 or not that testing interval is justified by those
7 considerations. Design operating experience. And the
8 main issue was what are the implications of operating
9 experience for the interval that has been chosen? And
10 I guess it would be true of the design as well. Any
11 event, that's the question that came up today.

12 MR. CUMMINS: This is Ed Cummins. This
13 configuration wasn't changed from Rev. 15's certified
14 design?

15 CHAIRMAN RAY: I hear you. I understand,
16 but the testing interval, I don't know, it's not
17 affected as well, I guess. I don't know. Do you?

18 MR. CUMMINS: The testing intervals in the
19 tech specs, Chapter 16 --

20 CHAIRMAN RAY: And Rev. 15?

21 MR. CUMMINS: Right.

22 CHAIRMAN RAY: Okay. All right.

23 MR. WANG: This action item?

24 CHAIRMAN RAY: Well, the --

25 MR. CUMMINS: It's up to you. I just

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1 wanted to put that fact in.

2 CHAIRMAN RAY: That's well-stated. That's
3 fine. Good input. But it does go to the certified
4 design. But make an action item out of it. We'll
5 have to discuss it and see if --

6 MEMBER BANERJEE: On these action items
7 related to GSI-191, would you make available also to
8 the staff the material that Graham wrote on downstream
9 effects?

10 MR. WANG: Yes, that's what I'm planning.

11 MEMBER BANERJEE: Because I don't know if
12 -- well, certainly they should have that available,
13 not specifically for AP1000, because we had just seen
14 the AP1000, but the other stuff. This is a generic
15 problem.

16 CHAIRMAN RAY: All right. We've gone
17 through the action items now, which is not to say that
18 there won't be anymore mention of them at this meeting
19 tomorrow, but at this point in time, as Eileen said,
20 there's probably not enough time allocated to the DCD
21 discussion with regard to water flow on the
22 containment. I assume that means what it says, which
23 is the water flow.

24 MR. WANG: Actually Sam, he specifically
25 asked to be here, so I think --

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1 CHAIRMAN RAY: No, I know. I know. We're
2 going to take that up tomorrow. And the point is
3 there's water drainage on the one hand, but the agenda
4 says corrosion issue discussion on the other hand,
5 which I put the corrosion issue in both the COL and
6 the DCD boxes. Maybe that's just the way I look at
7 it.

8 Anyway, since we'll probably need more
9 time, let's do 18 now.

10 MS. McKENNA: Okay.

11 CHAIRMAN RAY: If we can. Well, tomorrow
12 you guys were assigned 15 minutes for this. Let's see
13 if we can do it in that time.

14 MS. McKENNA: No, it wasn't 15.

15 CHAIRMAN RAY: What?

16 MS. McKENNA: It's an hour-fifteen.

17 CHAIRMAN RAY: Well, now wait a minute.
18 I'm sitting here looking at -- oh, COL Chapter 18.

19 MS. McKENNA: The COL is a shorter
20 presentation.

21 CHAIRMAN RAY: I beg your pardon.

22 MS. McKENNA: Yes.

23 CHAIRMAN RAY: I did read it correctly as
24 15 minutes, but it was the COL Rev. and the DCD.
25 Okay.

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1 MR. SEELMAN: Good afternoon again.

2 CHAIRMAN RAY: Yes.

3 MR. SEELMAN: Bob Seelman. This is
4 Chapter 18 of the Westinghouse DCD human factors
5 engineering. Thank you for taking the time to --

6 CHAIRMAN RAY: Thank you for being
7 flexible enough to do it today.

8 MR. SEELMAN: Okay. To my right is
9 subject matter expert Paul Hunton and Julie Reed to
10 the far right, subject matter expert for human factors
11 engineering.

12 In the fall of 2009 we presented to the
13 committee the design changes made to the certified
14 design. In this presentation we'll describe how we
15 addressed the COL information items. We will also
16 describe how we have addressed the ACRS item No. 34
17 DAC closure, which was just discussed during the open
18 items discussions.

19 And with that, I will turn it over to Mr.
20 Hunton.

21 MR. HUNTON: All right. Again, my name is
22 Paul Hunton. I am the AP1000 Program Manager for
23 Electronic Systems Integration and Human Factors.
24 I've been working with Julie Reed now for four years
25 in this area and Julie's been the fellow engineer

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1 who's been leading the technical work in the human
2 factors area.

3 The presentation that I'm about to give is
4 really just an update of the October 2009
5 presentation. I worked to stick with format of that
6 presentation, so there are many slides here that
7 you're going to see that are the same as were
8 presented in October, and I'll just go through them
9 quickly. Okay?

10 So, this first one here is just Chapter 18
11 overview. Presents just the governing NRC guidance in
12 the area of human factors engineering. Chapter 18 of
13 the AP1000 DCD is built around NUREG-0711, the
14 original version, July 1994. There were some minor
15 updates in May 2002. Also, the Human System Interface
16 Design review Guidelines, Revision 2, May 2002, those
17 were used as the guidance to help us develop our
18 AP1000 plant-specific human system interface style
19 guide, which we can discuss a little bit more as we
20 move through the presentation.

21 Any questions so far?

22 (No audible response.)

23 MR. HUNTON: Okay. Next slide. Okay.
24 These are the 13 elements that are listed in Rev. 1 of
25 NUREG-0700, program management, operating experience

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1 review, functional requirements analysis and
2 allocation, task analysis, staffing, integration of
3 human reliability with human factors, and the other
4 ones there as presented.

5 The design implementation, there are 13
6 bullets here. In the DCD there are 12 items. The
7 design implementation was written in Rev. 1 of NUREG-
8 0700 really addresses operating plant and the
9 discussion there is actually more folded into the
10 other items in our presentation and in the DCD.

11 Next slide, please. Okay. Westinghouse
12 has been working ever since Revision 15 of the DCD was
13 certified to continue to advance the human factors
14 engineering effort for AP1000. And it's been our
15 objective to complete the planning, analysis and
16 design phases of the DCD so that we would present to
17 the staff and to you at the ACRS that we are complete
18 with the three phases there. We've produced all the
19 documentation necessary for planning, analysis and
20 design and we've also produced sufficient V&V
21 documentation as far as plans go to close all COL
22 information items in Chapter 18 and to close all
23 design-related ITAAC.

24 Okay. Efforts since 2009. October is
25 when we were before you last. We've been continuing

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1 to implement the outstanding HFE program elements,
2 which I'll go through briefly. We continue to work,
3 as I stated, so that we could demonstrate and be
4 credited to close all COL information items in the
5 Chapter 18 area and the first four ITAAC which were
6 design ITAAC that were listed in table 3.2.1, Tier 1
7 of Rev. 15 of the DCD.

8 Since we were before you last we had a
9 face-to-face meeting with the NRC staff in December
10 2009. The objective of that was to sit down with the
11 staff, come to a clear understanding of what
12 additional work Westinghouse had to accomplish in
13 order to satisfy the staff that we had completed the
14 design phase and to provide sufficient information to
15 the NRC to determine that we closed the design phase,
16 and to demonstrate that we could close DAC item No. 4
17 from Rev. 15 of the DCD, which was to produce
18 verification and validation plans. We've also had
19 multiple telecons with the NRC since that time based
20 upon the understandings we reached in December 2009.
21 After the December 2009 meeting there were really no
22 additional open items. It was just a question of
23 producing the documentation and providing it to the
24 staff to close any items that we had in December. So,
25 we had multiple telecons, multiple RAI exchanges along

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1 with our responses for the final dispositions for the
2 design finalization items.

3 Okay. Next slide. Address operating
4 license information items. As I've stated before,
5 Westinghouse has endeavored to provide the NRC with
6 sufficient information to close all COL information
7 items in Chapter 18. And when it comes to design
8 ITAAC, we've worked to provide the staff with
9 sufficient information to close Tier 1, 3.2-1 items 1
10 through 4. So, the little bumper sticker there at the
11 end is to complete all design finalization items.

12 Any questions to this point?

13 CHAIRMAN RAY: Well, these seem like great
14 goals that you've set out. Not much to ask a question
15 about yet though.

16 MR. HUNTON: Okay. So, this is just a
17 list of all the COL information items from Rev. 15 of
18 the DCD. And again, multiple technical report and
19 design documents provided to the staff as bases to
20 close them. And I'm going to go through all of these
21 first and then we'll talk about the design ITAAC.

22 Another presentation. Go to the next
23 slide, please, Bob. Thank you. The only thing that's
24 different on the next set of slides you're going to
25 see is the column with current status. October 2009,

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1 those are the exact words we presented to you then.
2 If, like I say, show here for the first one, 18.2-1,
3 HFE program execution, it was presented back in
4 October 2009 that this item was closed. This is what
5 we presented and the staff concurred. So, the intent
6 of this presentation is to only address those items
7 that were not closed in October 2009. Okay?

8 So, when you see closed per October
9 meeting, it's my intent not to discuss those unless
10 you have a question. Okay?

11 So, 18.2-2, design of the emergency
12 operations facility, in October that item was still
13 open because we had yet to complete the task analysis
14 that we had committed to the staff that we were going
15 to perform that was essentially an output of our
16 workshop that we had with our utility customer when we
17 worked to address EOF and TSC functionality. We have
18 developed a tailored HFE program so that the items
19 that fall within the scope of the standard plant for
20 the emergency operations facility essentially
21 identifying the data that is provided by the standard
22 plant and providing displays that are necessary from
23 the standard plant control system to be available in
24 the TSC and EOF. We've had a workshop on that. We
25 performed a task analysis to ensure that the tasks

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1 associated with the EOF and TSC could be properly
2 executed. We submitted the task analysis report
3 there, the APP-OCS-J0A-001, to present our results to
4 the staff and the staff found those to be acceptable
5 and closed the open item there, COLP-18.

6 Okay. A confirmatory item was been in the
7 NRC's tracking system to document the applicant's
8 responsibility for the HFE design of the EOF and TSC.

9 The way this works is the applicants may be combining
10 their technical support centers and EOFs with
11 currently operating sites and sites that are new
12 AP1000s. So, the man/machine interface attributes
13 that are developed as part of the standard plant fall
14 within the licensing basis of AP1000. The applicant
15 is responsible as part of the overall TSC and EOF
16 layout per NUREG-0696 and NUREG-0737 for the
17 anthropometrics of those facilities. And they have to
18 demonstrate through a set of comprehensive drills that
19 the technical support center and EOF will perform
20 their functions. So, there's a shared responsibility
21 there, if you will, for EOF and TSC functionality.
22 We've addressed our part with the task analysis and
23 tomorrow the Vogtle applicant will be discussing what
24 they're doing as far as the EOF and TSC.

25 Any questions?

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1 (No audible response.)

2 MR. HUNTON: Okay. Next one, task
3 analysis. This was open in October. We had done our
4 function-based task analysis, our operational sequence
5 analysis 1 and 2. Both the plans and summary reports
6 were provided to the staff. The open items here had
7 to do with taking the results of those findings and
8 ensuring that they were rolled into the development of
9 plant procedures and the development of the plant
10 operating programs. So, the staff drew this open item
11 to track completion of these two documents that are
12 listed. Westinghouse has since provided both to the
13 staff. The staff has reviewed them and found the
14 content to be acceptable and closed the open item.

15 And 18.5-2, staff roles and
16 responsibilities, this was closed back in October
17 2009. We had an administrative change to the DCD here
18 where this document here -- we had two different
19 numbers at Westinghouse, so this document here, same
20 information provided but the document has been updated
21 in Rev. 18 of the DCD, and it's APP-GW-GJR-003. But
22 it's still closed per the October meeting. Okay?

23 Any questions on that last slide?

24 (No audible response.)

25 MR. HUNTON: Okay. COL item 18.7-1 and

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18.8-1 were closed per out meeting last October.

Next slide. Eighteen-nine-one, procedure development. The staff was satisfied with all the documentation that we had produced at our last meeting in October 2009, but there was one additional item that they wanted to ensure was covered, which was an audit of our computer-based procedures efforts. The staff came up and had actually performed the audit before we met with you in October of last year, but they had not yet documented their findings. They have since documented those findings in their audit report and the draft SER that you were provided by the staff found that that audit was satisfactory and the staff has determined that this item can be closed.

And under 18.11-1, we'll talk about this more in a second. This one was closed in October because it's redundant really with -- from Rev. 15 of the DCD ITAAC item No. 4, which is the last DAC, and is also covered by the first ITAAC, which is item 5 from Rev. 15 and item 1 for Rev. 18 because we're closing the first one.

Any questions on that last slide?

(No audible response.)

MR. HUNTON: Okay. This is the DAC status to address open item No. 34. Okay. The four DAC

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1 items we'll go through quickly.

2 First one was integration of human
3 reliability analysis with human factors engineering
4 design. This was closed per the October meeting for
5 the listed documents, OSA 1 and 2 complete and the
6 WCAP which described how we performed this activity.

7 DAC item No. 2 was task analysis performed
8 in accordance with the task implementation plan. The
9 implementation plan was approved in Rev. 15 of the
10 DCD. Our status in 2009 was we expected this to be
11 closed pending staff revision of the operational
12 sequence analysis, which was provided back in
13 September. There was an open item drawn on this and
14 the particular item there that needed to be addressed
15 was maintenance, test, inspection and surveillance
16 tasks. We have since provided an updated document
17 here. In 2009 we had produced as much of the analysis
18 as we could get done before the presentation October
19 2009. This MTIS task is what remained. We've since
20 completed that, provided it to the staff. The staff
21 has reviewed it, found it acceptable and has closed
22 the open item in this area. And for all of these DAC
23 items the draft safety analysis report from the staff
24 states that the objectives of all of them have been
25 met.

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1 So, next slide. DAC item No. 3 is HSI
2 design is performed in accordance with the HSI design
3 implementation plan. We had submitted the vast
4 majority of the documents to close this DAC item prior
5 to the meeting last October. That included our style
6 guide for human systems interfaces, functional
7 requirements and design specifications. So, staff had
8 reviewed all the ones that we had submitted and found
9 them to be acceptable. These two were outstanding,
10 the alarm presentation system design spec and the wall
11 panel information system hardware design spec. Both
12 of these were provided to the staff. The staff, the
13 statement there is these design specifications were
14 subsequently completed and found acceptable and the
15 staff has closed the open item that referenced these
16 two specifications.

17 Any question on DAC 3?

18 (No audible response.)

19 MR. HUNTON: Okay. DAC item 4, HFE
20 program verification and validation implementation
21 plans are developed in accordance with the
22 programmatic level description that was in Rev. 15 of
23 the DCD. This is where we've spent the vast majority
24 of our time since October of 2009. As of 2009 four of
25 the five documents were submitted at that point and

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1 found to be acceptable. Those documents include; and
2 I'll just make sure I list them all here exactly
3 right; this is section 1811 of the DCD, the design
4 verification plan which ensures that the design is
5 actually completed in accordance with all of our
6 design functional requirements and design specs, the
7 task support verification plan and ensures the
8 commitments that we made, and our task analyses were
9 properly followed through the design.

10 I'm going to skip over integrated system
11 validation quickly.

12 The human factors engineering discrepancy
13 resolution process, we're committed to have a formal
14 process to track any issues we find during the design
15 and capture them so that we can properly disposition
16 them.

17 And then we also developed a plant start-
18 up human factors engineering verification plan that
19 the as-built condition of the plant is congruent with
20 the HFE program.

21 The one I skipped over was the one that we
22 had not completed to the NRC staff's satisfaction in
23 October 2009, which was the integrated system
24 validation plan. The open item was drawn there to
25 track satisfactory completion. And as the SER goes

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1 into expansive detail on -- the NRC reviewed the ISV
2 plan and we decoupled the scenarios, the individual
3 scenarios from the plan. The plan basically describes
4 all the programmatic elements that are necessary for
5 integrated system validation. The scenario
6 information is very specific to the plant design and
7 as the design is completed we will flesh out the
8 scenarios in all cases.

9 How many scenarios are there exactly, do
10 you know?

11 MS. REED: There are 24 scenarios.

12 MR. HUNTON: Okay.

13 CHAIRMAN RAY: Twenty-four what?

14 MS. REED: Twenty-four and that includes
15 start-up, shutdown and risk important human actions
16 and various other complications. And there are a
17 total of 24 scenarios.

18 MR. HUNTON: And the staff required us to
19 produce multiple examples of completed scenarios so
20 that they would have an adequate sample of the
21 scenarios that we are going to be running into the
22 details so that they were comfortable that we could
23 take -- go from the generic integrated system
24 validation plan in -- the 320 document is listed there
25 and develop very specific scenarios descriptions so

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1 that we fully covered what we committed to do in the
2 ISV plan.

3 The staff reviewed both GEH-320, which was
4 the plan, and the scenario information. Found both of
5 them to be satisfactory and closed the open item in
6 this area.

7 Any questions on this slide?

8 (No audible response.)

9 MR. HUNTON: Okay. So, conclusions.
10 Westinghouse is continuing to execute the human
11 factors program certified in Rev. 15. And we've
12 reached a point now at this point in the process that
13 we can close all the COL information items and we can
14 close all DAC in Chapter 18. All that remains is for
15 us to perform -- and when I say "all," there's a
16 significant portion of work that remains, but in
17 licensing space is to perform our different
18 verification and validation activities per our NRC-
19 reviewed plans, document the results, provide those to
20 the staff in the first ITAAC and then essentially
21 validate the as-built conditions.

22 And that's really all I have. Last slide
23 is just a picture of the control room.

24 CHAIRMAN RAY: Why can't everybody else do
25 it this way?

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1 MR. HUNTON: That organization is the one
2 that did all the design work. Julie Reed, Steve Kerch
3 and others in that organization, Santy Alvarez and
4 Mike Shaffer, and all the staff working for them. I
5 used to be directly involved in that and I've since
6 transferred to a different group, but I've been
7 continuing to maintain this function. But ultimately
8 it's their hard work that brought us to this point.

9 DR. WALLIS: And this control room, all
10 the screens show the same picture. Is that redundancy
11 or something?

12 MR. HUNTON: This is just to show you --
13 oh, if you'd like it to be, the screens are
14 configurable. But this is just meant to give you a
15 feel for what the control room looks like.

16 CHAIRMAN RAY: Any questions?

17 (No audible response.)

18 CHAIRMAN RAY: Thank you. Eileen, I think
19 we have time for the staff, if they're available.

20 MS. McKENNA: Actually, I think the staff
21 would rather do their presentation in the morning.
22 What I could offer the committee is the Vogtle
23 applicant is prepared to do their presentation on
24 Chapter 18. And then we could do the staff's on both
25 of those tomorrow.

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1 CHAIRMAN RAY: All right.

2 MR. SPARKMAN: Thank you.

3 CHAIRMAN RAY: Well, Wes, we wouldn't have
4 wanted you to waste your time coming here today.

5 MR. SPARKMAN: Never. Never a waste of
6 time. I think Bob Hirmanpour will be joining me for a
7 sec.

8 MR. HIRMANPOUR: Yes, I was looking for a
9 name tag from last time, but we'll skip the name tag.

10 MR. SPARKMAN: Skip the name tags. You
11 know us.

12 I'm Wes Sparkman with Southern Nuclear,
13 and beside me Bob Hirmanpour with NuStart. We also
14 have support from a variety of personnel in the
15 audience in case there are any questions. We're going
16 to cover the COL Chapter 18 topics.

17 Okay. As has been our process in the
18 past, the items that are blue'd out are the ones that
19 we're going to cover, that we still have items we want
20 to discuss.

21 Next slide. Major topics of Chapter 18.
22 The DCD is incorporated by reference fully. There is
23 one site-specific departure taken, which is the TSC
24 location. As Paul talked about, some utilities want
25 to have something different than what the DCD has, and

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1 we are one of those utilities. We're going to have a
2 single TSC which covers both 3 and 4, and 1 and 2 on
3 the site.

4 There are four COL information items. The
5 advance FSER was issued with no open items.

6 Chapter 18 does include some supplemental
7 information related to COL information items and
8 includes two VEGP site-specific items, which are the
9 TSC location and the fact that we have a common EOF.

10 CHAIRMAN RAY: Is this a new TSC?

11 MR. SPARKMAN: It will be.

12 CHAIRMAN RAY: So, it's large enough to
13 accommodate support of all four units if there were a
14 need for that?

15 MR. SPARKMAN: Yes, that is correct.
16 We'll talk about the COL items first. COL information
17 item 18.2-2. It states specific information regarding
18 the location of the emergency operations facility and
19 the emergency operation facility communications will
20 be provided by the Combined Operating License
21 Applicant to address the combined license information
22 requested in this subsection. The VEGP-specific
23 response to that is included in the COL and that the
24 EOF and the TSC communication strategies as well as
25 the EOF and TSC human factors attributes are described

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1 in the emergency plan. It was submitted as part of
2 the ESP. And then Part 5 of the COL has a few
3 changes, supplements to the emergency plan which was
4 incorporated by reference from the ESP.

5 Also, FSAR Section 9.5.2.2.5 provides
6 additional information related to off-site interfaces
7 such as ENS, HPN and others with respect to
8 communications.

9 The resolution also included the following
10 change to the emergency plan. The original emergency
11 plan which was submitted as part of the ESP did not
12 include a reference to NUREG-0696. Even though the
13 emergency operation facility has been established
14 consistent with that functional criteria, we went
15 ahead and put a reference in, or will as part of the
16 emergency plan. And that's included in Part 5 of the
17 COL.

18 COL information item 18.6-1, combined
19 license applicants referencing the AP1000 design will
20 address the staffing levels, qualifications of plant
21 personnel including operations, maintenance,
22 engineering, instrumentation and control technicians,
23 radiological protection technicians, security and
24 chemists. The number of operators needed to directly
25 monitor the control of the plant from the main control

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1 room including the staffing requirements of 10 CFR
2 50.54(m) will be addressed. These items are addressed
3 in a variety of different places. Table 13.1-201
4 contains the estimated staffing levels for those
5 categories of personnel that are addressed by the
6 human factors engineering program. The minimum level
7 of staffing for control room personnel who directly
8 monitor and control a plant is stated in table 13.1-
9 202 and also meets the requirements of 10 CFR
10 50.54(m).

11 Information about staffing levels of
12 security personnel is contained in the separately
13 submitted physical security plan, and that was
14 submitted under a separate letter and recently revised
15 along with submittal 6 of the COL. Qualification
16 requirements of plant staff are discussed in Chapter
17 13 and again for security personnel in the physical
18 security plan.

19 COL information item 18.10-1 states, see
20 Section 13.2 for discussion of the responsibility for
21 training program development. Information regarding
22 the training program development is located in
23 Section 13.2, which is training, and the training
24 organization roles and responsibilities of training
25 personnel are discussed in Section 13.1,

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1 organizational structure of the applicant.

2 And COL information item 18.4-1, which is
3 the last one, is also a standard response. The item
4 itself states human performance monitoring applies
5 after the plant is placed in operation and is a
6 Combined License Applicant responsibility. Guidance
7 and additional information on the objectives, scope
8 and methods of such programs presented in Element 12
9 of NUREG-0711, human factors engineering program
10 review model.

11 Human performance monitoring applies after
12 the plant is placed in operation and this process
13 implements the guidance and methods described in
14 NUREG-0711. That monitoring provides reasonable
15 assurance that the design can be effectively used by
16 personnel, changes do not have adverse effects on
17 personnel performance and human actions can be
18 accomplished within time and performance criteria.

19 And continuing on with the rest of this
20 resolution, the human performance monitoring process
21 is structured such that human actions are monitored
22 commensurate with their safety importance, feedback of
23 information and corrective actions are accomplished in
24 a timely manner and degradation in performance can be
25 detected and corrected before plant safety is

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1 compromised.

2 So, this is human performance monitoring
3 process for risk-informed changes is integrated in the
4 correction action program, training program and other
5 programs as appropriate. Identified human performance
6 conditions and issues are evaluated for human factors
7 engineering applicability.

8 So, throughout our training process and a
9 corrective action process we will track any issues
10 related to human factors and any design changes that
11 are risk-informed will be evaluated, and any human
12 factors issues that arise from CRs will be evaluated
13 for their impact.

14 Are there any questions?

15 CHAIRMAN RAY: No, I think we'll look to
16 the staff's review for any issues that warrant our
17 attention, but thank you.

18 MR. SPARKMAN: Thank you very much.

19 CHAIRMAN RAY: All right. Okay. With
20 that, Eileen, are we done for the day?

21 MS. McKENNA: Yes, I think that brings us
22 to the last agenda item where we need discussion. And
23 so I'll turn it back to you.

24 CHAIRMAN RAY: I mean, if there's
25 something else we should do today, we'll do it. But

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1 otherwise, we'll adjourn and resume tomorrow morning.

2 Any comment from any of the members?

3 (No audible response.)

4 CHAIRMAN RAY: With that said then, 8:30
5 tomorrow. Thank you.

6 (Whereupon, the meeting was adjourned at
7 4:10 p.m. to reconvene tomorrow at 8:30 a.m.)
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AP1000 Design Control Document Amended Design

Chapter 8 – Electric Power

Bob Seelman – AP1000 Licensing

Mark DeMaglio – AP1000 Electrical Systems Integration

September 20, 2010

Chapter 8 – AP1000™ Electrical Agenda

1. Governing NRC Guidance
2. Overview
3. Efforts Since October 2009
4. Conclusion

Chapter 8 – Governing NRC Guidance

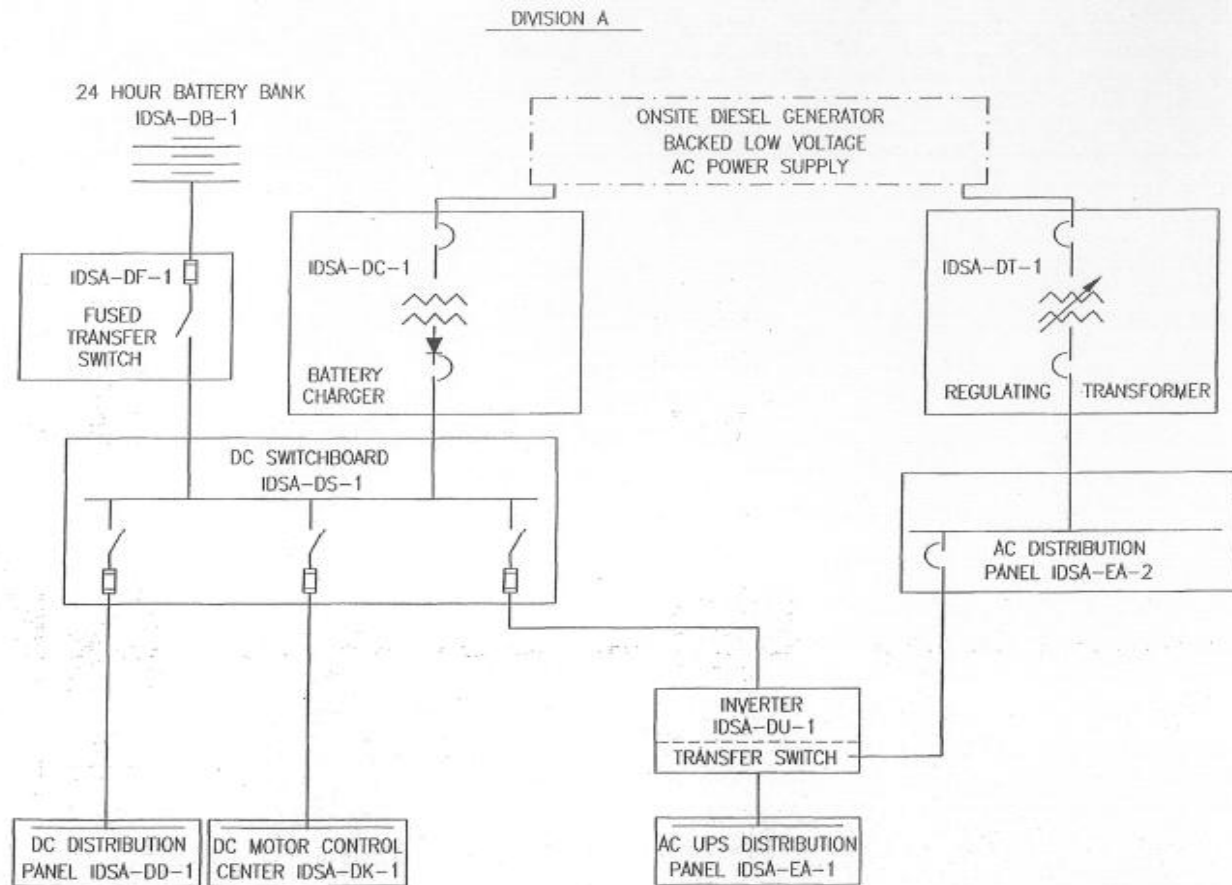
- ac power systems (including diesel backed systems) have no safety function – conformance to GDC, Reg Guides, and Class 1E IEEE Standards generally not required
 - Exceptions are stated in Table 8.1-1
- Class 1E dc power design is based on the GDC, Reg Guides, and IEEE Standards listed in DCD Rev 17, Section 8.1.4.3

Chapter 8 Overview

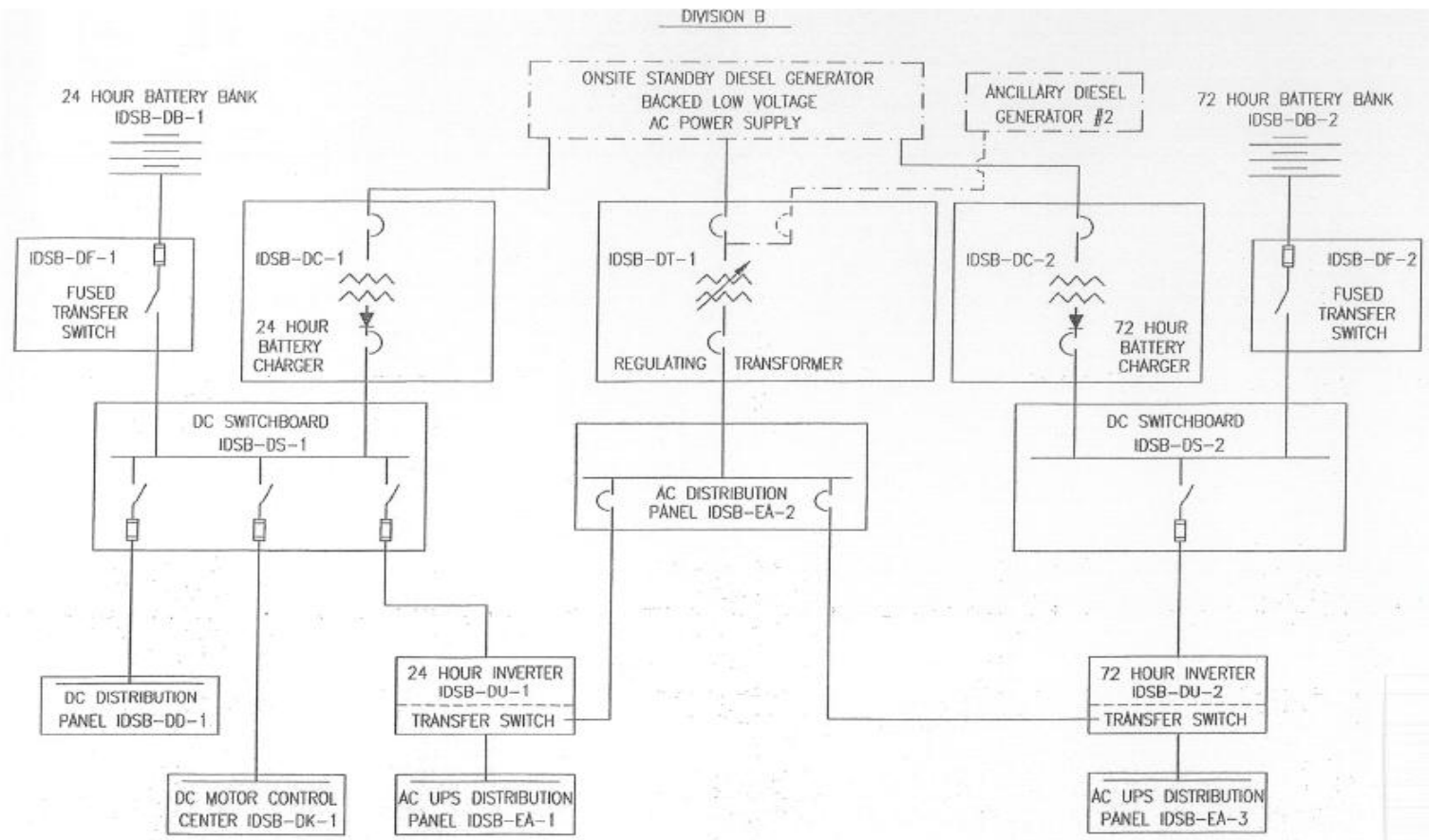
The AP1000 design does not utilize Class 1E alternating current (ac) electrical power, except that provided by the Class 1E direct current (dc) batteries and their inverters, to accomplish the plant's safety-related functions.

The AP1000 design does not utilize any Class 1E ac motors.

Chapter 8 Overview - Typical for Divisions A and D



Chapter 8 Overview - Typical for Divisions B and C



Chapter 8 - Efforts Since October 2009

OI-SRP8.3.2-EEB-03: Load Profiles for 24/72 Hour Batteries

- The applicant was asked to discuss battery margins (aging margin, design margin, temperature correction factor, and margin associated with float current for 100 percent state of charge) and the expected service life of these batteries.
- Resolved. Westinghouse provided for Staff review battery sizing calculations. The staff determined that the battery qualification program and the applicable surveillance requirements per plant Technical Specifications would ensure that the batteries would envelop their designed load profiles throughout their designed life.
- DCD Reference: Tier 2 Tables 8.3.2-1 thru 4

Chapter 8 - Efforts Since October 2009

OI-SRP8.3.2-EEB-04: Test Plan for Safety Related Batteries

- Staff requested that the test plan be captured in the DCD as part of the AP1000 licensing basis
- The DCD is being revised to state that the AP1000 qualification test program meets or exceeds IEEE standards.
- Resolved. CI-SRP8.3.2-EEB-04.
- DCD Reference: Chapter 8, Section 8.3.2.1

Chapter 8 - Efforts Since October 2009

OI-SRP8.3.2-EEB-05: Adequacy of dc Power Systems

- Westinghouse provided for Staff review - battery sizing calculations, terminal voltage calculations, short circuit calculations, and voltage drop calculations.
- Staff verified that AP1000 Class 1E batteries are sized in accordance with the recommendations of IEEE Standards. The Staff also noted a need to add clarity to the calculation. The calculation is being revised to add clarity to support the DCD.
- OI-SRP8.3.2-EEB-05 is resolved.
- DCD Reference: DCD Rev 17, Tier 2, Section 8.2.1

Chapter 8 - Efforts Since October 2009

OI-SRP8.3.2-EEB-08: Configuration Control to the Applicant

- The Staff was concerned with consistency in the transfer to the COL Applicant the analysis, calculations, studies, and assumptions related to safety-related electrical equipment.
- Westinghouse provides an applicant with a configuration controlled model developed through the use of the Electrical Transient Analysis Program TM and supporting documentation.
- OI-SRP8.3.2-EEB-08 is resolved.
- DCD Reference: Tier 1, Figure 2.6.2-1

Chapter 8 - Efforts Since October 2009

OI-SRP8.3.2-EEB-09: Battery Chargers and Voltage Regulating Transformers; Inverter Protection

- To ensure periodic testing of the battery chargers and voltage regulating transformers, the Staff requested that a COL Information Item be added to the DCD. In addition, the Staff requested that inverter DC input protection trip setpoint and time delay should be set higher than the battery charger trip setpoints and time delay to prevent the inverter tripping before the battery charger.
- Westinghouse is making the appropriate wording changes to the DCD. This item is resolved: CI-SRP8.3.2-EEB-09
- DCD Ref: 8.3.3 Combined License Information for Onsite Electrical Power; 8.3.2.1.4 Maintenance and Testing

Conclusions

The Advanced Final Safety Evaluation Report for the AP1000 DCD Chapter 8 –

The open items are resolved.

There are 2 Confirmatory Items:

- CI-SRP8.3.2-EEB-04 resolved pending verification
- CI-SRP8.3.2-EEB-09 resolved pending verification

Questions?



Presentation to the ACRS Subcommittee

**Westinghouse AP1000 Design Certification Amendment
Application Review**

**AFSER Chapter 8
Electric Power Systems**

September 20-21, 2010

Staff Review Team

- Technical Staff
 - **Om Chopra**, Senior Electrical Engineer
- Project Management
 - Dave Jaffe

Overview

- Chapter 8 of the AP1000 AFSER was briefed on October 20, 2009 with a total of 5 Open Items based on Revision 17
 - List of Open Items (OI)
 - OI SRP 8.3.2-EEB-3: Load Profile for each 24-hour and 72-hour battery
 - **OI SRP 8.3.2-EEB-4: Battery Qualification**
 - OI SRP 8.3.2-EEB-5: Battery and Battery Charger Sizing Calculations
 - OI SRP 8.3.2-EEB-8: AC System Design Calculations
 - **OI SRP 8.3.2-EEB-9: Coordination Between Battery Chargers and Inverters**
 - All Open Items Resolved
 - Two Confirmatory Items

OI SRP 8.3.2-EEB-4

Test Plan to Qualify 24 and 72-hour Long Duty Cycle Batteries

- Battery qualification will be demonstrated by type testing. The applicant's test plan satisfies the recommendations of IEEE Standard 323-1974, IEEE Standard 344-1987, and IEEE Standard 535-1986. The applicant will revise the DCD to provide a summary of its test plan.
- This is Confirmatory Item 8.3.2-1.

OI SRP 8.3.2-EEB-9

Coordination Between Battery Chargers and Inverters

- Staff was concerned about the effect of voltage transients during islanding mode of operation
 - The design includes trip coordination between battery chargers, and inverters, so that battery chargers trip first on excessive high voltage so that inverters continue to supply safety-related loads using stored energy from batteries. The applicant will revise the DCD to include this coordination.
- Staff was also concerned about the testing of battery chargers and voltage regulating transformers used as isolation devices in AP1000 design. These devices are designed to limit the input (ac) current to an acceptable value under faulted conditions on the output side
 - A COL Information Item will be added to the DCD to ensure that periodic testing is performed on the these devices to verify their current-limiting characteristics are not compromised or lost. The applicant will revise the DCD to make it a COL information item.
- This is Confirmatory Item 8.3.2-2.

AP1000 Design Control Document Amended Design

Chapter 18 – Human Factors Engineering

Bob Seelman – AP1000 Licensing

Paul J. Hunton – NPP Electronic Systems Program Manager

Julie Reed – Human Factors and Operations Fellow Engineer

September 21, 2010

Chapter 18 Overview

Governing NRC Guidance:

- Human Factors Engineering Program
 - NUREG-0711 “Human Factors Engineering Program Review Model,” U.S NRC, July 1994
 - NUREG-0711, Revision 1, May 2002
- Human System Interface Design Review Guidelines
 - NUREG-0700, Revision 2, May 2002

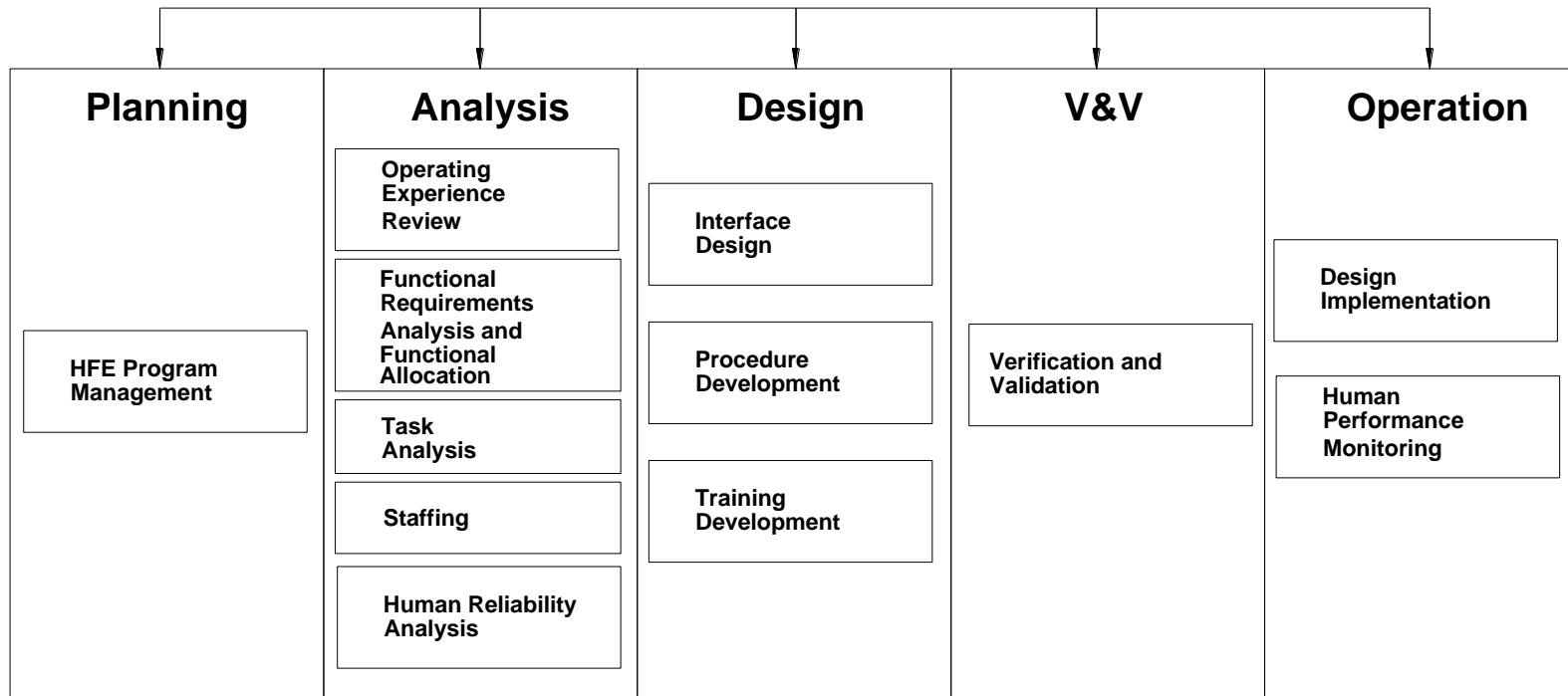
Human Factors Engineering Program

Elements Comprising the AP1000 HFE Program

- Program Management
- Operating Experience Review
- Functional Requirements Analysis & Allocation
- Task Analysis
- Staffing
- Integration of Human Reliability Analysis with HFE
- Human System Interface Design
- Procedure Development
- Training Program Development
- Human System Interface Verification and Validation Program
- Inventory (minimum inventory of indications, alarms, and controls)
- Design Implementation
- Human Performance Monitoring

AP1000 HFE Process (DCD Figure 18.1-1)

Human Factors Engineering (HFE) Design and Implementation Process



Efforts Since October 2009

- Continuing to Implement outstanding HFE program elements
- Work since DCD Rev 15 continues to be credited to close
 - COL Information Items
 - Design ITAAC
- Face to Face Meeting with NRC Staff in December 2009 and multiple teleconferences/RAIs to establish final dispositions for Design Finalization items.
- Produced necessary documentation to complete HFE Design Finalization efforts.

Chapter 18 Licensing and DCD

Address Combined Operating License (COL) Information Items

- Provide sufficient information to the NRC to close all Chapter 18 COL Information Items

Address Design Inspection, Test, Analysis, and Acceptance Criteria (DAC)

- Provide sufficient information to the NRC to close Tier 1, Table 3.2-1 items 1-4 from DCD Rev. 15

Complete All Design Finalization Items

DCD Rev. 15 Design COL Items

Table 1.8-2 (Sheet 7 of 7)
**SUMMARY OF AP1000 STANDARD PLANT
COMBINED LICENSE INFORMATION ITEMS**

Item No.	Subject	Subsection
18.2-1	Execution of the NRC Approved Human Factors Engineering Program	18.2.6
18.2-2	Design of the Emergency Operations Facility	18.2.6
18.5-1	Task Analysis	18.5.4
18.5-2	Main Control Room	18.5.4
18.7-1	Execution and Documentation of the Human Reliability Analysis/Human Factors Engineering Integration	18.7.1
18.8-1	Execution and Documentation of the Human System Interface Design Implementation Plan	18.8.5
18.9-1	Procedure Development	18.9.1
18.11-1	Verification and Validation of AP1000 Human Factors Engineering Program	18.11.1

Multiple Technical Reports & Design Documents Provided to NRC Staff
as Bases to Close COL Information Items

Chapter 18 COL Information Item Status

COL Item	Subject	October 2009 Status	Current Status
18.2-1	HFE Program Execution	Closed: Redundant with Design ITAAC (DAC) <ul style="list-style-type: none">• HFE Program Plan (APP-OCS-GBH-001) provided to NRC	Closed (per October Meeting)
18.2-2	Design of the Emergency Operations Facility	Open: NRC Draft SER proposes that this item be revised (per RAI response). NRC open Item OI-SRP18-COLP-18 to track TSC/EOF Task analysis completion.	<ul style="list-style-type: none">• OI-SRP18-COLP-18 is closed. Applicant has developed a sufficient basis for applying a tailored HFE program to the TSC and EOF and has documented the TSC and EOF task analysis results in APP-OCS-J0A-001: HFE Analysis to Support TSC and EOF Design.• Confirmatory Item CI-SRP18-COLP-21 to document the COL Applicant's responsibility for the HFE design of the EOF and TSC is CLOSED

Chapter 18 COL Information Item Status

COL Item	Subject	October 2009 Status	Current Status
18.5-1	Task Analysis	<p>Open: Pending review of:</p> <ul style="list-style-type: none"> • APP-OCS-GER-031: "The Incorporation of HFE into the Development of AP1000 Plant Procedures" • APP-OCS-GER-041: "The Incorporation of HFE into the Development of the AP1000 Plant Training Programs" • OI-SRP18-COLP-17 tracked completion of these documents 	<p>Closed:</p> <ul style="list-style-type: none"> • APP-OCS-GER-031 and APP-OCS-GER-041 submitted to NRC • Staff determined content to be acceptable. • OI-SRP18-COLP-17 is closed.
18.5-2	Main Control Room Staff Roles/Responsibilities	<p>Closed</p> <ul style="list-style-type: none"> • APP-GW-GLR-010: "AP1000 Main Control Room Staff Roles and Responsibilities" 	Closed (per October meeting)

Chapter 18 COL Information Item Status

COL Item	Subject	October 2009 Status	Current Status
18.7-1	Execution and Documentation of Human Reliability Analysis/Human Factors Engineering Integration	Closed Addressed by: <ul style="list-style-type: none">• WCAP 16555, "AP1000 Identification of Critical Human Actions and Risk Important Tasks"• Operational Sequence Analysis (OSA) 1 & 2	Closed (per October meeting)
18.8-1	Execution and Documentation of the Human System Interface Design Implementation Plan	Closed: Redundant with Design ITAAC (DAC)	Closed (per October meeting)

Chapter 18 COL Information Item Status

COL Item	Subject	October 2009 Status	Current Status
18.9-1	Procedure Development	Open: Closed pending NRC confirmation in CBP audit report: (audit performed 9/15/09)	Closed: Computer Based Procedure audit findings captured in SER
18.11-1	Verification and Validation of AP1000 Human Factors Engineering Program	Closed: Redundant with Design ITAAC (DAC)	Closed (per October meeting)

ACRS Action Item #34 AP1000™ Design Acceptance Criteria (DAC) Closure

DAC Status (Rev. 15 Table 3.2-1)

DAC Item	Subject	October 2009 Status	Current Status
1	Integration of Human Reliability Analysis with Human Factors Engineering Design	Closed (WCAP-16555, OSA 1 & 2)	Closed (Per October Meeting)
2	Task Analysis is performed in accordance with the task analysis implementation plan.	<p>Open:</p> <ul style="list-style-type: none">• Expect to be closed pending staff review of Revision B of APP-OCS-J1R-220 , “AP1000 Operational Sequence Analysis (OSA-2) Summary Report” (provided 9/30/09)• OI-SRP18-COLP-02A opened for tracking MTIS Tasks	<p>Closed:</p> <ul style="list-style-type: none">• APP-OCS-J1R-220 reviewed by the Staff and found acceptable.• OI-SRP18-COLP-02A is closed.

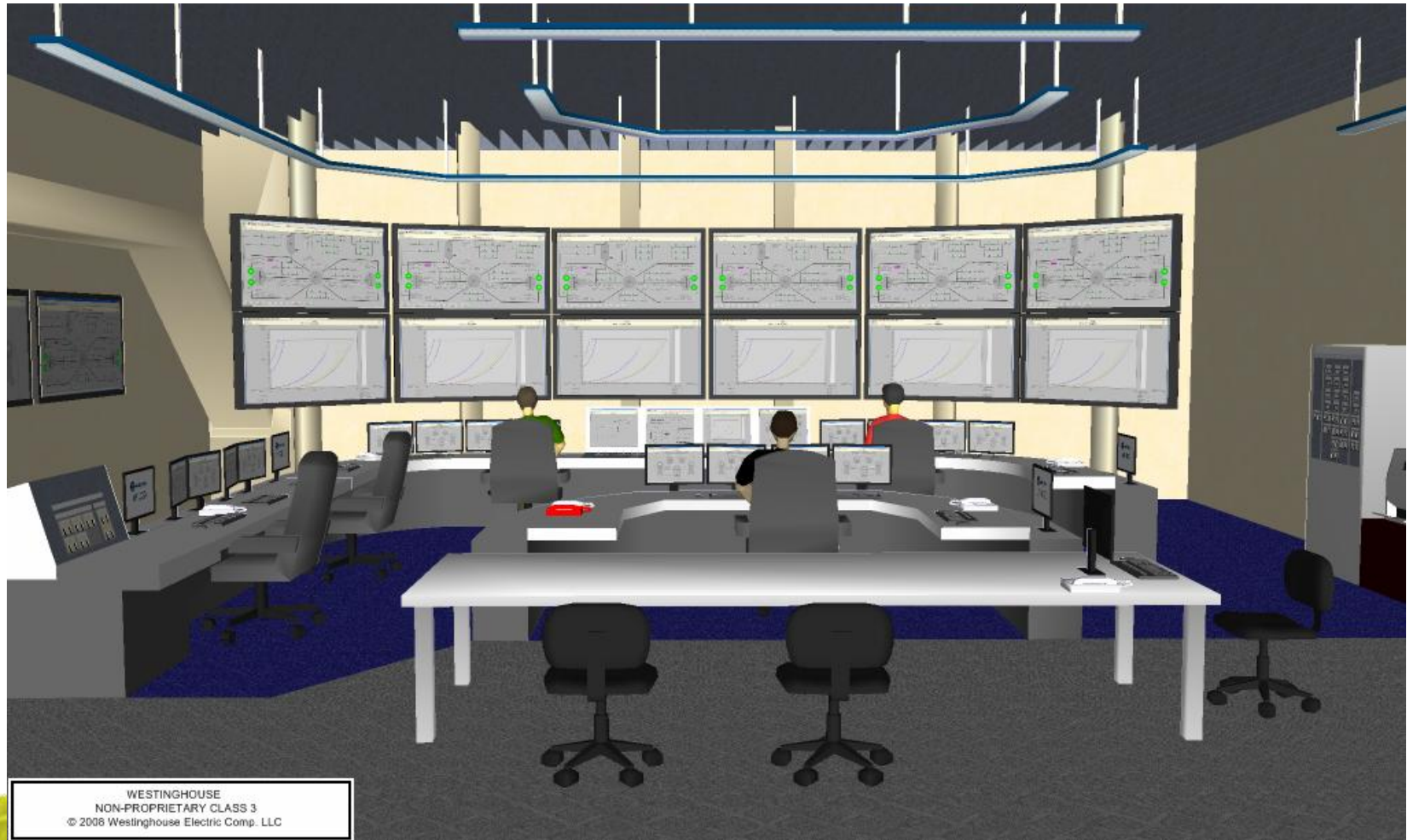
DAC Status (Rev. 15 Table 3.2-1)

DAC Item	Subject	October 2009 Status	Current Status
3	The HSI design is performed for the OCS in accordance with the HSI design implementation Plan	<p>Open: Outstanding documents provided and await NRC review</p> <ul style="list-style-type: none"> • APP-OCS-J4V-001, "Control Centers Alarm Presentation System Design Specification" • APP-OCS-J4-002, "Wall Panel Information System Hardware Design Specification" • OI-SRP18-COLP-01A created to track above items 	<p>Closed</p> <ul style="list-style-type: none"> • "These design specifications were subsequently completed..." • OI-SRP18-COLP-01A satisfactorily addressed and is closed.
4	An HFE program verification and validation implementation plan is developed in accordance with the programmatic level description of the AP1000 human factors verification and validation plan	<p>Open:</p> <ul style="list-style-type: none"> • 4 of 5 documents required to close this item have been accepted as satisfactory. The remaining document (APP-OCS-GEH-320, "AP1000 Human Factors Engineering Integrated System Validation Plan") is under revision to address NRC RAIs. • OI-SRP18-COLP-03A created to track the above item 	<p>Closed</p> <ul style="list-style-type: none"> • APP-OCS-GEH-320 (ISV Plan) and APP-OCS-GEH-321 (ISV Scenario Information) submitted to the NRC. • OI-SRP18-COLP-03A satisfactorily addressed and is closed.

Conclusions

- Westinghouse is executing the Human Factors Program Certified in DCD Revision 15.
- COL Information Items
 - 9 of 9 items have been closed.
- DAC Items from Rev. 15, Tier 1 Table 3.2-1
 - Items 1 through 4 have been met
 - ACRS Action Item #34 closed

Current AP1000 Main Control Room



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AP1000 Reference Combined License Application Presentation to ACRS Chapter 18 Topics

September 21, 2010

Wes Sparkman

R-COLA Chapter 18: Standard Topics

Human Factors Engineering

18.1 Overview

18.2 Human Factors Engineering Program Management

18.3 Operating Experience Review

18.4 Functional Requirements Analysis and Allocation

18.5 AP1000 Task Analysis Implementation Plan

18.6 Staffing

18.7 Integration of Human Reliability Analysis with Human Factors Engineering

18.8 Human System Interface Design

18.9 Procedure Development

18.10 Training Program Development

18.11 Human Factors Engineering Verification and Validation

18.12 Inventory

18.13 Design Implementation

18.14 Human Performance Monitoring

R-COLA Chapter 18: Major Topics

- DCD incorporated by reference
 - One Site Specific Departure taken (TSC Location)
- Four COL information items
- AFSER Issued with no Open Items.
- Chapter 18 includes supplemental information related to COL information items
- Chapter 18 includes two VEGP Site Specific Items (TSC Location and Common EOF).

R-COLA Chapter 18: COL Items

COL Information Item 18.2-2

Specific information regarding the location of the emergency operations facility and emergency operations facility communications will be provided by the Combined Operating License applicant to address the Combined License information requested in this subsection.

Resolution of COL Item 18.2-2 (VEGP Specific)

The EOF and TSC communications strategies, as well as the EOF and TSC Human Factors attributes, are described in the Emergency Plan. FSAR Section 9.5.2.2.5 provides additional information related to offsite interfaces.

COL Item resolution also included the following change to the Emergency Plan:

The Emergency Operations Facility has been established consistent with NUREG 0696, "Functional Criteria for Emergency Response Facility."

R-COLA Chapter 18: COL Items

COL Information Item 18.6-1

Combined License applicants referencing the AP1000 design will address the staffing levels and qualifications of plant personnel including operations, maintenance, engineering, instrumentation and control technicians, radiological protection technicians, security, and chemists. The number of operators needed to directly monitor and control the plant from the main control room, including the staffing requirements of 10 CFR 50.54(m), will be addressed.

Resolution of COL Item 18.6-1 (Standard)

Table 13.1-201 contains the estimated staffing levels for those categories of personnel that are addressed by the Human Factors Engineering program. The minimum level of staffing for control room personnel who directly monitor and control the plant is stated in Table 13.1-202 and meets the requirements of 10 CFR 50.54(m). Information about the staffing levels of security personnel is contained in the separately submitted physical security plan.

Qualification requirements for plant staff are discussed in Chapter 13, and for security personnel in the physical security plan.

R-COLA Chapter 18: COL Items

COL Information Item 18.10-1

See Section 13.2 for a discussion of the responsibility for training program development.

Resolution of COL Item 18.10-1 (Standard)

Information regarding training program development is located in Section 13.2, Training. The training organization and roles and responsibilities of training personnel are discussed in Section 13.1, Organizational Structure of Applicant.

R-COLA Chapter 18: COL Items

COL Information Item 18.14-1

Human performance monitoring applies after the plant is placed in operation, and is a Combined License applicant responsibility. Guidance and additional information on the objectives, scope, and methods of such programs are presented in Element 12 of NUREG-0711, "Human Factors Engineering Program Review Model."

Resolution of COL Item 18.14-1 (Standard)

Human performance monitoring applies after the plant is placed in operation. The human performance monitoring process implements the guidance and methods as described in NUREG-0711.

The human performance monitoring process provides reasonable assurance that the design can be effectively used by personnel, changes do not have adverse effects on personnel performance, and human actions can be accomplished within time and performance criteria.

R-COLA Chapter 18: COL Items

Resolution of COL Item 18.14-1 (Standard) – Continued

The human performance monitoring process is structured such that human actions are monitored commensurate with their safety importance, feedback of information and corrective actions are accomplished in a timely manner, and degradation in performance can be detected and corrected before plant safety is compromised (e.g., by use of the plant simulator during training exercises).

The human performance monitoring process for risk-informed changes is integrated into the corrective action program, training program and other programs as appropriate. Identified human performance conditions/issues are evaluated for human factors engineering applicability.

**AP1000
DCWG**



AP1000



R-COLA Chapter 18

Backup Slides